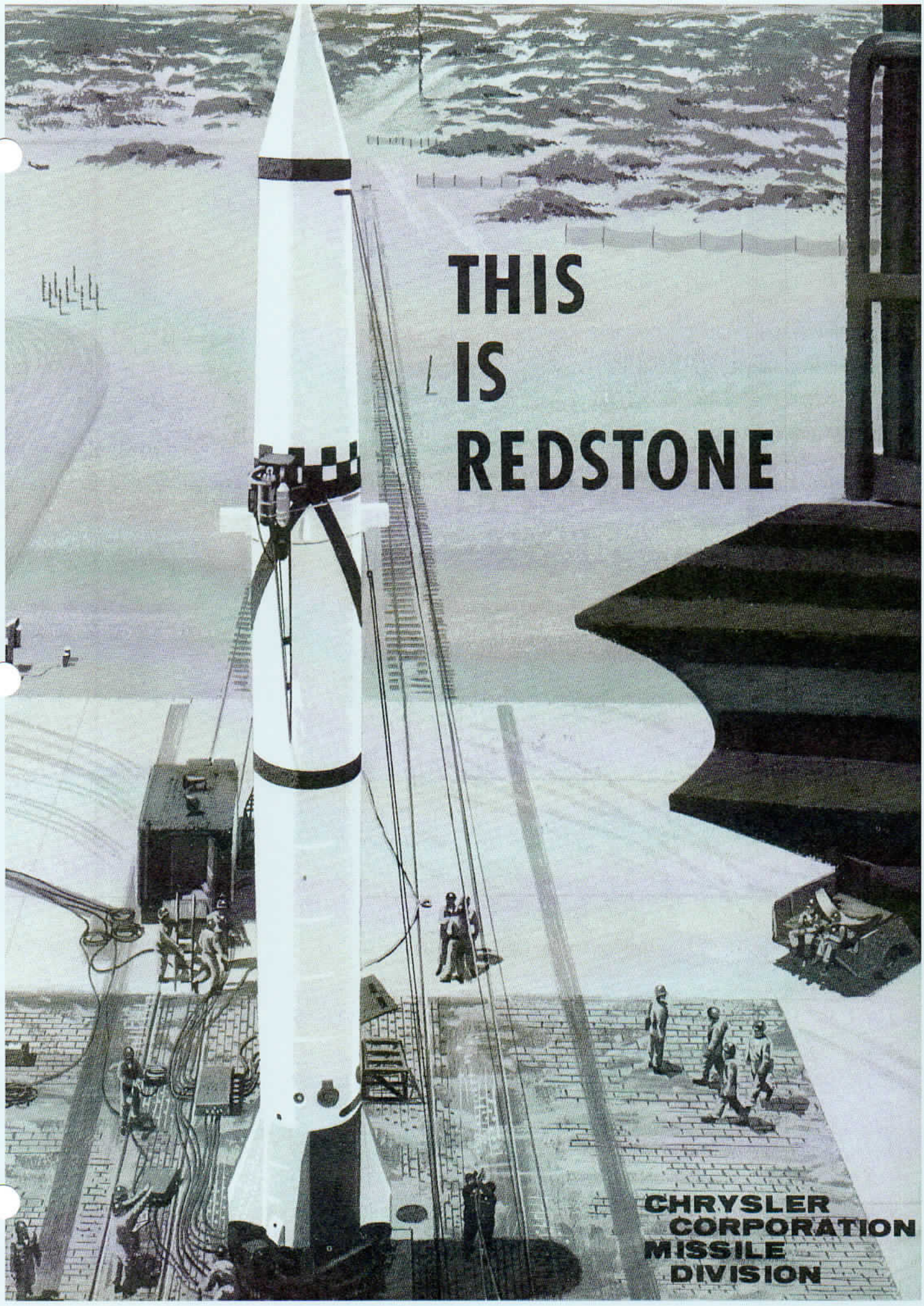
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CHRYSLER CORPORATION
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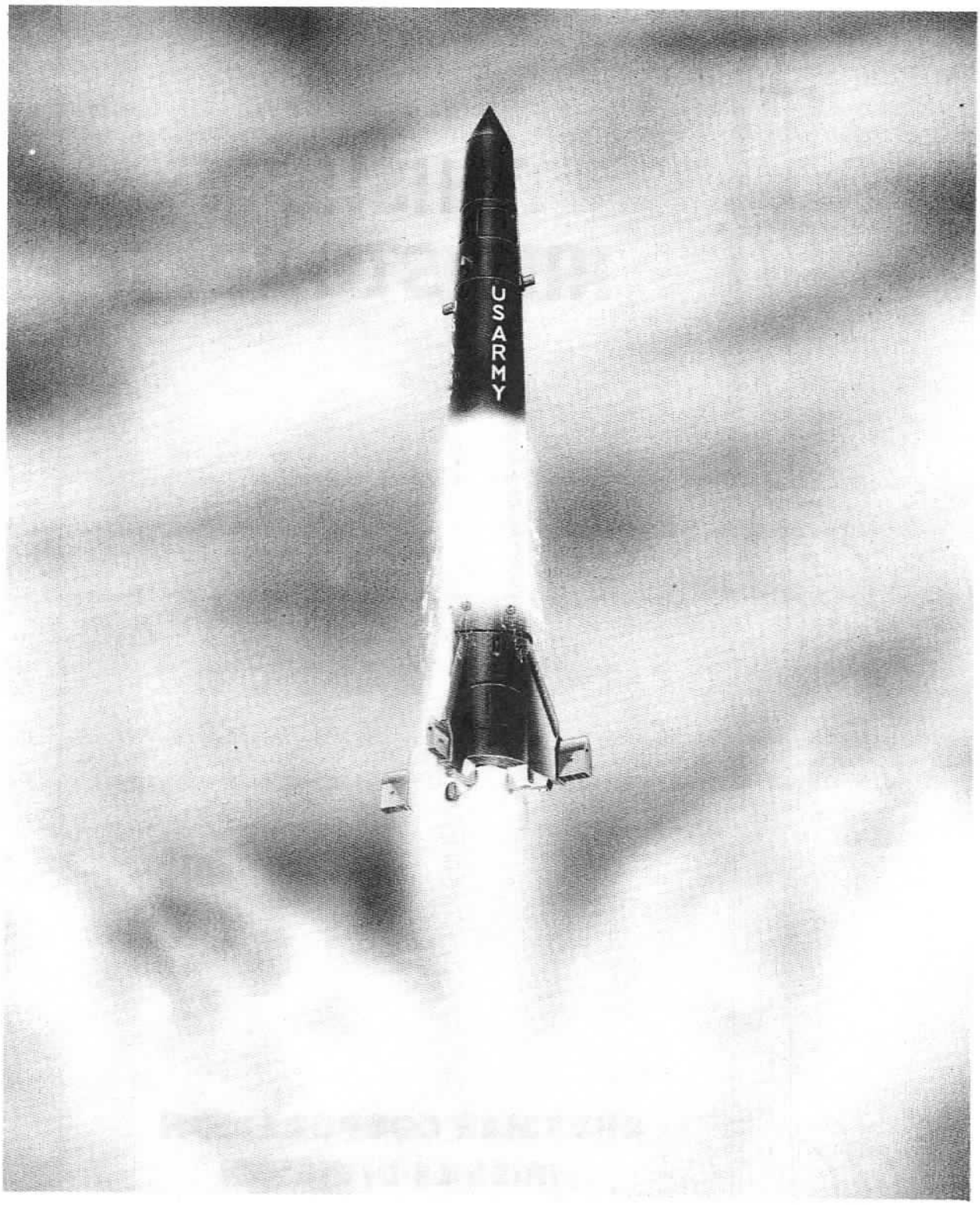

Frontispiece – Ballistic Guided Missile XM8; Ballistic Shell

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)

LIST OF TABLES

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CHAPTER I
REDSTONE HISTORY

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CHAPTER I

REDSTONE HISTORY

GENERAL

During the 1945-50 period of limited funds and limited sense of urgency, the Army built the facilities, assembled the talent, and accumulated the basic knowledge needed to produce its missile systems. At the White Sands Missile Range (then Proving Ground), established in 1944, American and former German missilemen fired V-2's and other missiles under experimental conditions. By 1950 they had fired, in upper-atmosphere experiments, some 67 missiles using V-2 components.

Missile and Space Research

Experimentation performed during those years points up the inseparability of missile and space research. The German V-2, an operational weapon, was used frequently as a space research vehicle. Army's CORPORAL developed in opposite fashion. It began life as a test vehicle and was converted to an operational missile in the early 1950's. In the Fall of 1945, the Army fired its first WAC CORPORAL to an altitude of 43 miles. In February 1946, it launched a BUMPER. This was another test vehicle with a V-2 as first stage and a WAC CORPORAL as the second stage. The BUMPER provided valuable information concerning the separation and ignition of a rocket's second stage in highly rarefied air. It also gave data on the stability of the second stage at extremely high velocities and altitudes and the aerodynamic effects of high Mach numbers. The altitude it attained, 250 miles, stood as a world record for years.

The interrelation of missilery and space activities is personified, of course, by such Army scientists as Drs. von Braun, Stuhlinger, and their colleagues at the Army Ballistic Missile Agency (ABMA). During the 1920's and 1930's these men became interested in rockets and missiles solely as a means of exploring outer space. But the knowledge of rocketry they gained was adapted to military use, first by the German Army, then by the U.S. Army. When these space enthusiasts helped

build the JUPITER C, which was used for space exploration, they completed a cycle in their professional lives.

Thus, when the Space Age arrived, a missile-minded Army had the facilities, equipment, and talent to participate in it.

CHRYSLER'S ROLE

During the Korean War, the Navy selected Chrysler to construct and operate a plant to produce Pratt & Whitney J-48 Turbo-Wasp jet engines. Plant construction began on 27 October 1951, and in mid-July, 1952, just before production was to begin, the Navy cancelled the contract. Chrysler completed the 2,100,000 square foot plant, and the Navy assigned this facility to Chrysler for other defense work.

In the summer of 1952, ABMA was seeking a prime contractor for the REDSTONE Missile. Teams were sent to talk to the managements of a number of corporations who had the potential to become prime contractors. In October, 1952, Chrysler received a contract from the Department of Defense to assist ABMA with the design and production of REDSTONE Missiles. The Jet Engine plant was converted into a missile manufacturing facility. Chrysler engineers were integrated into important segments of the Redstone Arsenal at Huntsville, Alabama. This effort was expanded in 1956, when ABMA was activated.

The first REDSTONE Missile was built by the Army and fired in August, 1953, approximately two years after the first studies were initiated.

In November, 1955, the first Chrysler-built missile (designated as number 13) was delivered. Missiles 1 through 12 were built by the Army.

Missile 13 was transported to Huntsville and disassembled to evaluate the production quality. The missile was reassembled and launched a year later (in July of 1956).

The REDSTONE, which was the first ballistic missile to be put into production by Chrysler, is commonly referred to as "the father of American ballistic missiles" and has an unequalled record of successful firings. The 40th Field Artillery Group was the first tactical field unit to be equipped with the REDSTONE. On 16 May 1958, at Cape Canaveral, Florida, Battery A of the 40th Field Artillery Group conducted the first successful troop launching of a REDSTONE Missile.

Making and Assembling the REDSTONE Missile

Mass production concepts stemming from automotive experience have been employed by Chrysler Corporation in the development of fabrication and assembly operations for the REDSTONE Missile. The Chrysler-operated Michigan Ordnance Missile Plant is the only one of its kind operated by a motor car manufacturer and Chrysler is said to be the first U.S. missile builder to place large ballistic missiles in scheduled production.

Chrysler has made enormous strides in the development of facilities, methods, and tooling in this plant. It is a highly organized facility complete with equipment for manufacturing, testing, quality control, and all the elements required to produce a missile ready for deployment to the armed forces here and overseas.

Moreover, a team called the Advanced Projects Organization was formed within the Chrysler Defense Group to specialize in the concept and planning of new weapon and space system projects.

The laboratory testing techniques that were employed in developing the REDSTONE tactical nose cone provide an example of how automotive experience can be harnessed in other directions. Not only was the high-speed re-entry problem solved, but the project was developed on a highly compressed time schedule at low cost. The nose cone was found to be completely successful in its first test firing.

One of the unusual features of this facility is the 60-foot steel tower used for testing missiles under simulated dynamic loading and pressure conditions encountered in actual firings. During testing each missile is filled with a suitable liquid to simulate the density of the LOX and fuel. Fuel tanks are also hydrostatically pressurized to simulate the pressures encountered in flight.

There are many other unique testing devices. Among the more important are: a vertical test stand in the laboratory which moves like a pendulum to simulate the conditions of pitch experienced in flight due to wind force (instrumentation is provided to check on the behavior of control stabilizers which correct for wind force effects during flight); a vibrating "shake" table that duplicates the vibrations experienced during launching; a centrifugal test machine, mounted in a pit, designed to impress loading up to 100g on components; a cone-shaped furnace lined with infrared lamps to study the effect of high temperature on nose cones during reentry; an electronic system for determining the center of gravity of each missile, by components and for the assembled missile.

TYPE

The REDSTONE Missile is an Army Field Artillery Tactical Missile. As a weapon, it is considered to be a long-range surface-to-surface ballistic (projectile) type rocket. As a missile, it is considered to be a medium-range vehicle because it has a range of less than 500 miles.

The thrust necessary to lift the missile off the launcher and to propel the missile during the phase of flight is supplied by means of a single bipropellant liquid rocket (air-independent) engine. This engine develops 78,000 pounds of thrust and propels the missile at supersonic speeds (Mach 4.8). The missile is directed in flight from liftoff to impact by an inertial guidance and control system.

TABLE I-I – Missile Systems

Type and/or Designation		Description and/or Explanation	REDSTONE
Range	Short	Less than 500 miles	x
	Long	Greater than 500 miles (ICBM) and (IRBM)	
Mach No.	Subsonic	Speed less than Mach 1	
	Transonic	Speeds less than Mach 1 to speeds greater than Mach 1	
	Sonic	Mach 1 (speed of sound)	
	Supersonic	Speeds greater than Mach 1	x
	Hypersonic	Speeds greater than relaxation time	
Propulsion	Air independent	Does not use air - Rocket Engine	x
	Air dependent	Uses Air - Jet Engine	
Guidance	Inertial	An automatic navigation system which uses gyroscopic devices.	x
	Preset	Control equipment contained wholly within the missile.	
	Command	Missile's guidance comes from outside the missile. Receiver in missile receives directions from a ground station or mother aircraft.	
	Homing	Usually at end of flight. Radar, heat, and light are homing devices.	

TABLE I-I – Missile Systems (Cont'd)

Type and/or Designation		Description and/or Explanation	REDSTONE
Guidance (Cont'd)	Beam Rider	Missile contains equipment which enables it to follow an electronic beam.	
	Radio Navigation	Consists of master and slave stations that emit low-frequency pulses at constant intervals.	
	Terrestrial	A system of map matching is commonly used. Other systems may use earth gravitational, magnetic, and electrical fields.	
	Celestial	Complex system. A mechanism takes celestial fixes and keeps missile on course electronically.	
Aerodynamic	Projectile	Similar to a bullet	x
	Winged	Airfoil surfaces - similar to airplanes.	
Structure	Reinforced shell	Skin reinforced with complete framework of members.	
	Semimonocoque	Skin reinforced with longerons and bulkheads.	x
	Full monocoque	Skin reinforced with bulkheads.	
Branch of Service	A	Air Force	
	N	Navy	
	G	Army	x
	ANG	All three	
Type	TM	Tactical Missile	x
	SM	Strategic Missile	

TABLE I-I – Missile Systems (Cont'd)

Type and/or Designation		Description and/or Explanation	REDSTONE
Type (Cont'd)	IM	Interceptor Missile	
	GAR	Guided Aircraft Rocket	
	GAM	Guided Aircraft Missile	
Use	SAM	Surface-to-Air Missile	
	AAM	Air-to-Air Missile	
	ASM	Air-to-Surface Missile	
	SSM	Surface-to-Surface Missile	x
	AUM	Air-to-Underwater Missile	
	SUM	Surface-to-Underwater Missile	
	USM	Underwater-to-Surface Missile	
	UAM	Underwater-to-Air Missile	
Status	X	Experimental	
	Y	Service Test	x
	Z	Obsolete	
Test	TV	Test Vehicle	
	A	Aerodynamic	
	C	Control	
	L	Launch	
	P	Propulsion	
	R	Research	
Model	1	First Model	
	2	Second Model	
	3	Third Model	

TABLE I-I – Missile Systems (Cont'd)

Type and/or Designation		Description and/or Explanation	REDSTONE
Modification	a	First Modification	
	b	Second Modification	
	c	Third Modification	

Example: The Regulus 1 Missile – SSM-N-8a
SSM – Surface-to-Surface Missile
N – Navy Buaer
8 – Eighth Model
a – First Modification

TABLE I-II – REDSTONE and JUPITER-C Highlights

Missile	Event	Date Fired
1	First REDSTONE Fired	20 August 1953
13	First Chrysler-built Missile (delivered 14 November 1955)	19 July 1956
27	First Deep Penetration of Space (JUPITER C)	20 September 1956
32	First Chrysler Missile Shipped Directly to AMR	14 March 1957
40	First Nose Cone Recovery (JUPITER C)	8 August 1957
42	First Tactical Top	10 December 1957
29	EXPLORER I (JUPITER C)	31 January 1958
1002	First Troop Firing	16 May 1958
44	EXPLORER IV (JUPITER C)	26 July 1958
50	HARDTACK	1 August 1958
51		12 August 1958

FUNCTION AND CAPABILITIES

Primarily, the REDSTONE Missile is for tactical field operation by U.S. Army personnel, (Field Artillery Missile Battalion) in order to provide general support to a field army, to fulfill the requirements for a medium-range missile, to supplement or extend the range of firepower of existing artillery weapons, to provide increased heavy power fire support for deployed ground combat forces, and to compensate for expanding dimensions of the battle area.

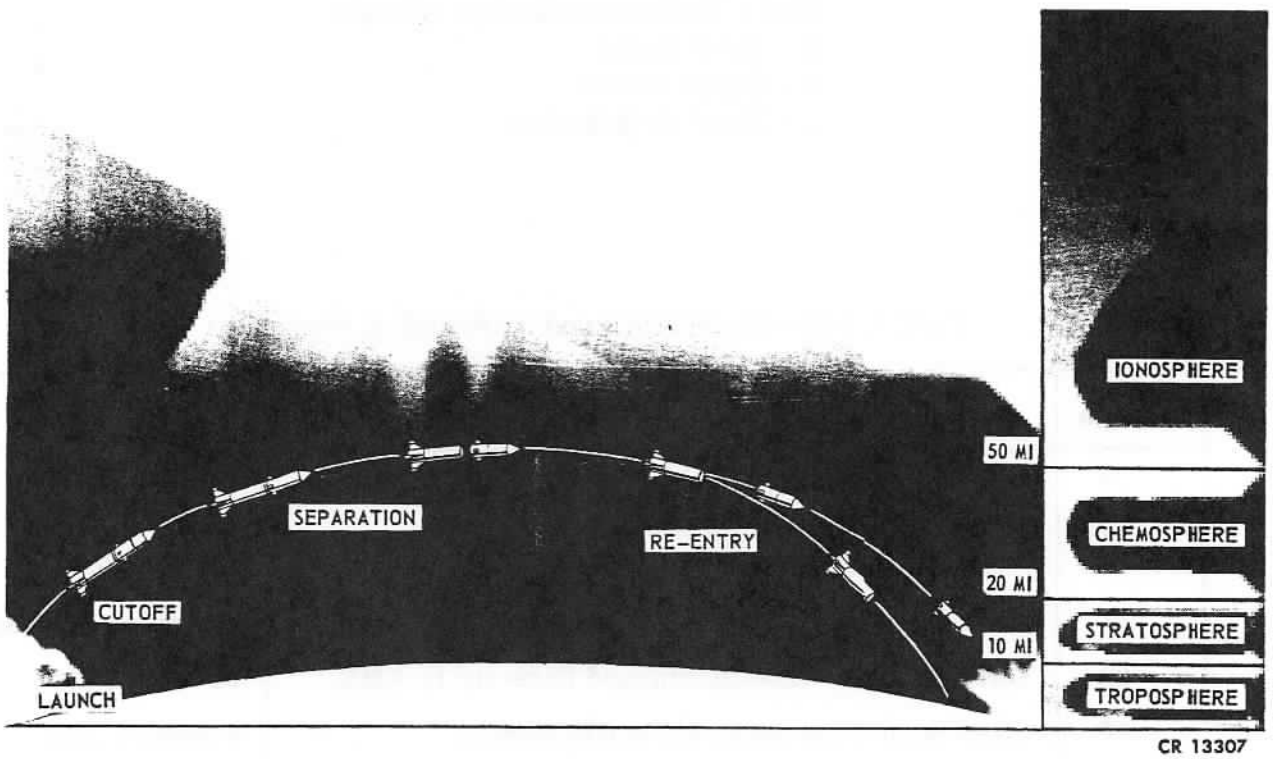


Figure I-1 – Missile Flight Phases

CHAPTER II
MISSILE STRUCTURE

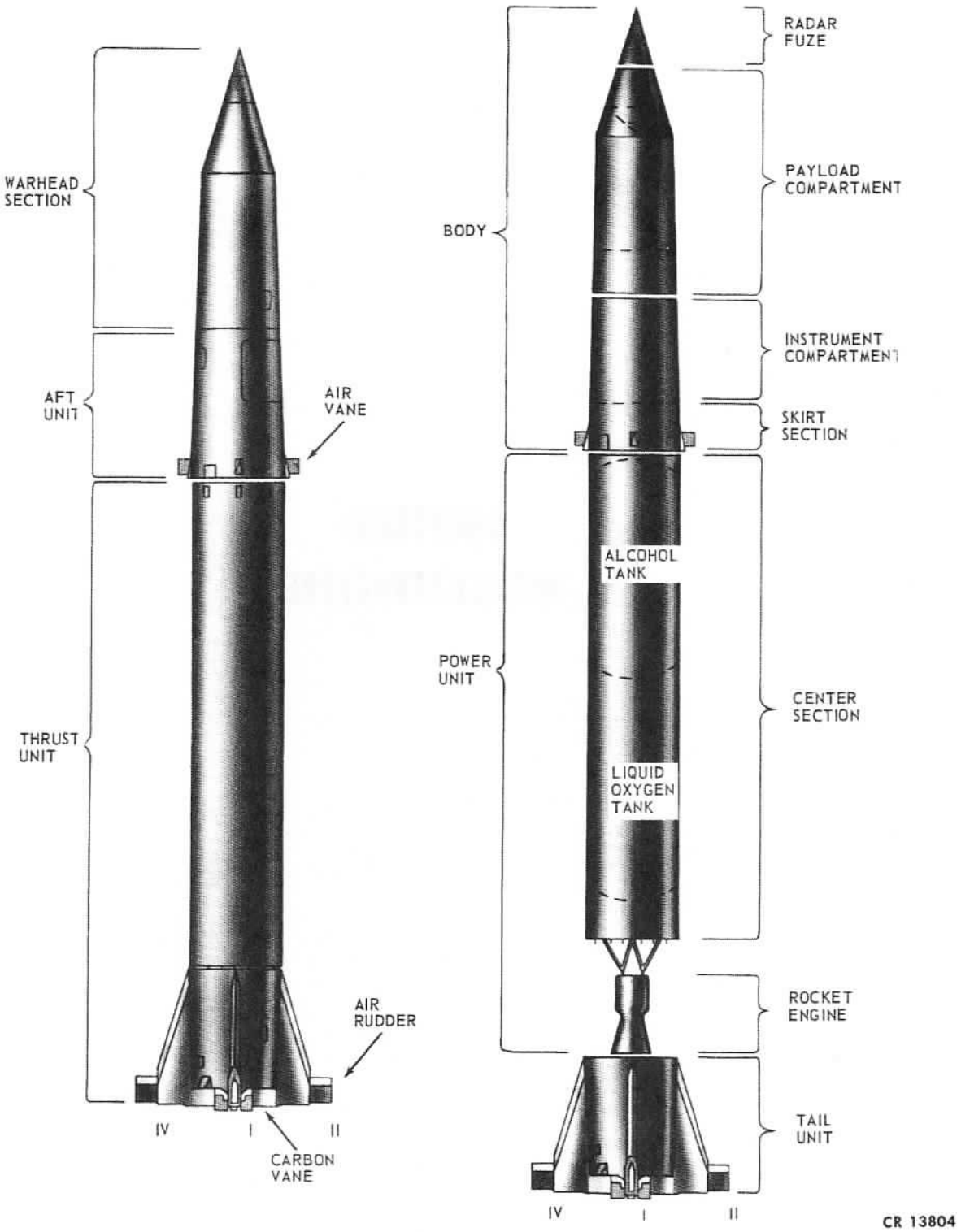


Figure II-1 – Missile Structure

CHAPTER II
MISSILE STRUCTURE

GENERAL

The missile consists of two major parts: the body unit and the thrust unit. The body is subdivided into two main units, the nose (or warhead) unit and the aft unit. The instrument compartment, which contains the guidance and control equipment, is located in the aft unit. The thrust unit is also subdivided into two main units, the center unit and the tail unit, which contain the propellant (LOX and alcohol) tanks and the rocket engine, respectively.

The locations of missile components are referred to as "forward" for components located toward the nose of the missile and "aft" for those located toward the tail. Viewing the missile from the tail, the location of components may also be specified with respect to the air vanes or rudders.

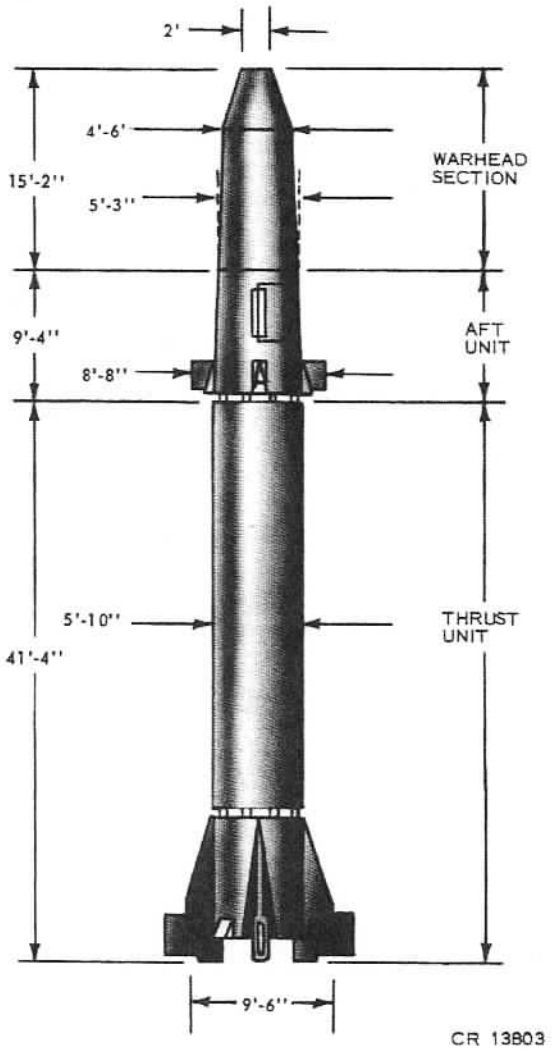
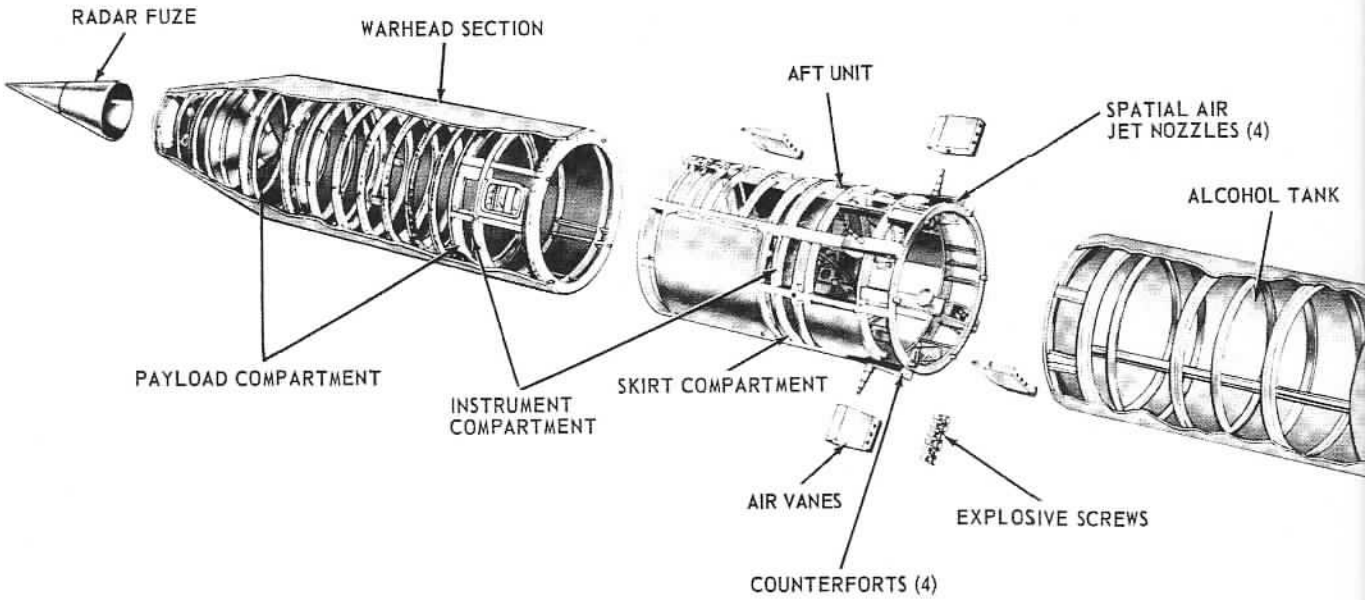


Figure II-2 – Missile Dimensions



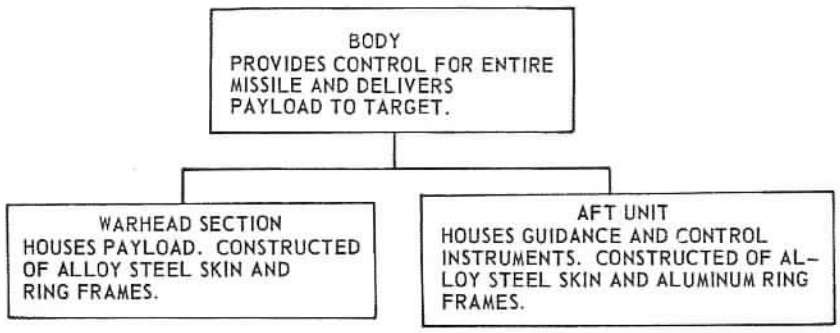
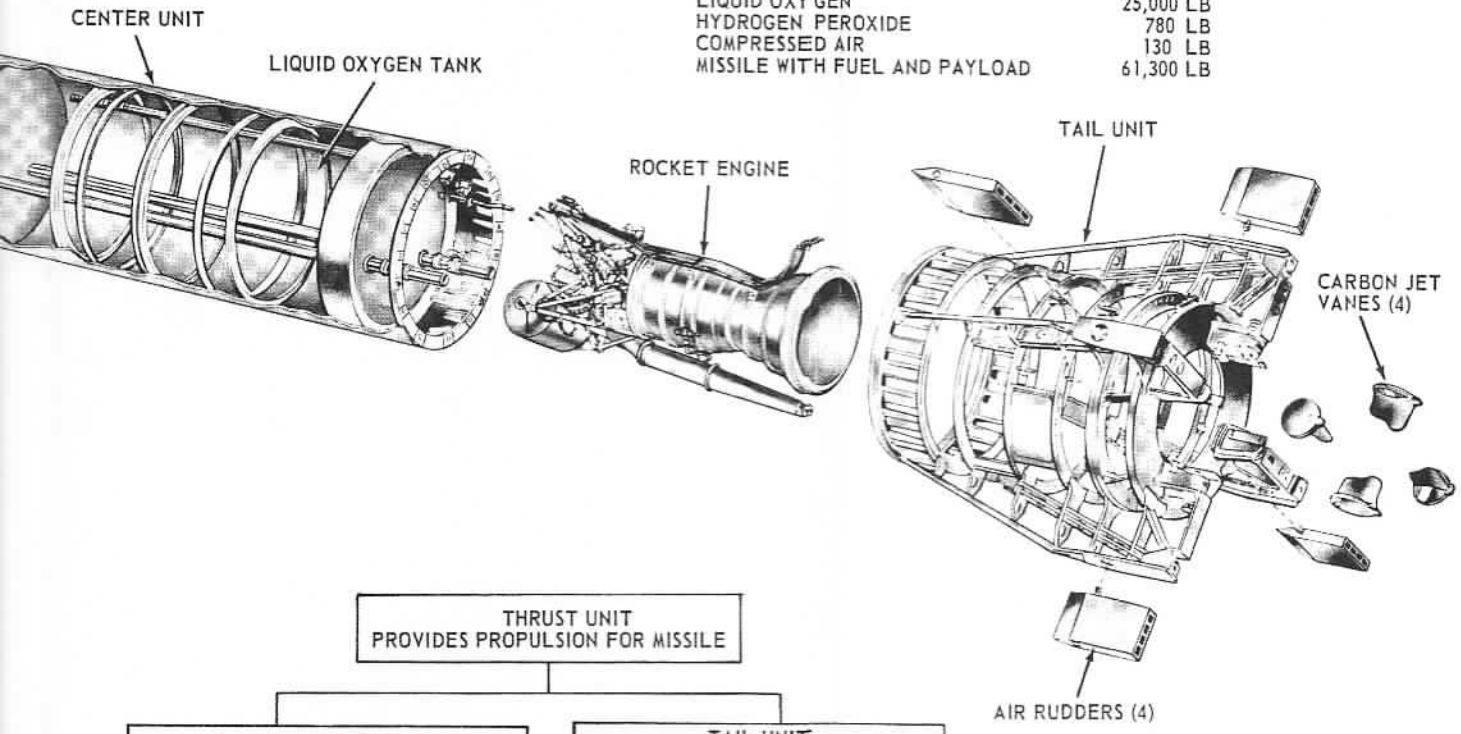


Figure II-3 – Ballistic Missile Shell (Exploded View)

MISSILE XM8

APPROXIMATE LENGTHS:	
OVERALL ASSEMBLED	69 FT.
RADAR FUZE	4 FT.
WARHEAD SECTION	15 FT.
AFT UNIT	9 FT.
THRUST UNIT	41 FT.
APPROXIMATE MISSILE WEIGHT EMPTY	16,500 LB
APPROXIMATE LIFT-OFF WEIGHTS:	
ALCOHOL	18,800 LB
LIQUID OXYGEN	25,000 LB
HYDROGEN PEROXIDE	780 LB
COMPRESSED AIR	130 LB
MISSILE WITH FUEL AND PAYLOAD	61,300 LB



THRUST UNIT
PROVIDES PROPULSION FOR MISSILE

CENTER UNIT
CARRIES ALCOHOL AND LIQUID OXYGEN. CONSTRUCTED OF ALUMINUM SKIN AND RING FRAMES.

TAIL UNIT
HOUSES ROCKET ENGINE AND SUPPORTS CONTROL SURFACES. CONSTRUCTED OF ALUMINUM SKIN AND RING FRAMES.

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NOSE UNIT

The nose (or warhead) unit consists of a skin of alloy steel that is riveted and welded to a framework of former rings, bulkheads, and stringers. This construction is required in order to enable the nose unit to withstand the high pressure, temperature, and corrosive conditions encountered at re-entry. The pressure reaches 95 psi and the temperature rises to 1000°F on the forward portion of the body (nose unit) when it re-enters the atmosphere. All exterior surfaces are painted with zinc chromate to provide corrosion protection.

The first ring frame is designed as a flange mounting for the fuze cone which is fastened to the nose unit with six machine screws. The last ring of the nose unit has a flanged surface for mating the nose to the aft unit.

A conically shaped metal support, used as one of the mounting surfaces for the payload, is located near the forward end of the nose unit. The aft payload support of the payload compartment is flat, and has a circular opening in the center section. The open center section of this support permits access to the payload compartment for maintenance and is covered by the base of the payload. The payload base is seated against a silicone rubber gasket to provide an airtight seal. This seal is required because the payload support also forms the forward end of the pressurized instrument compartment.

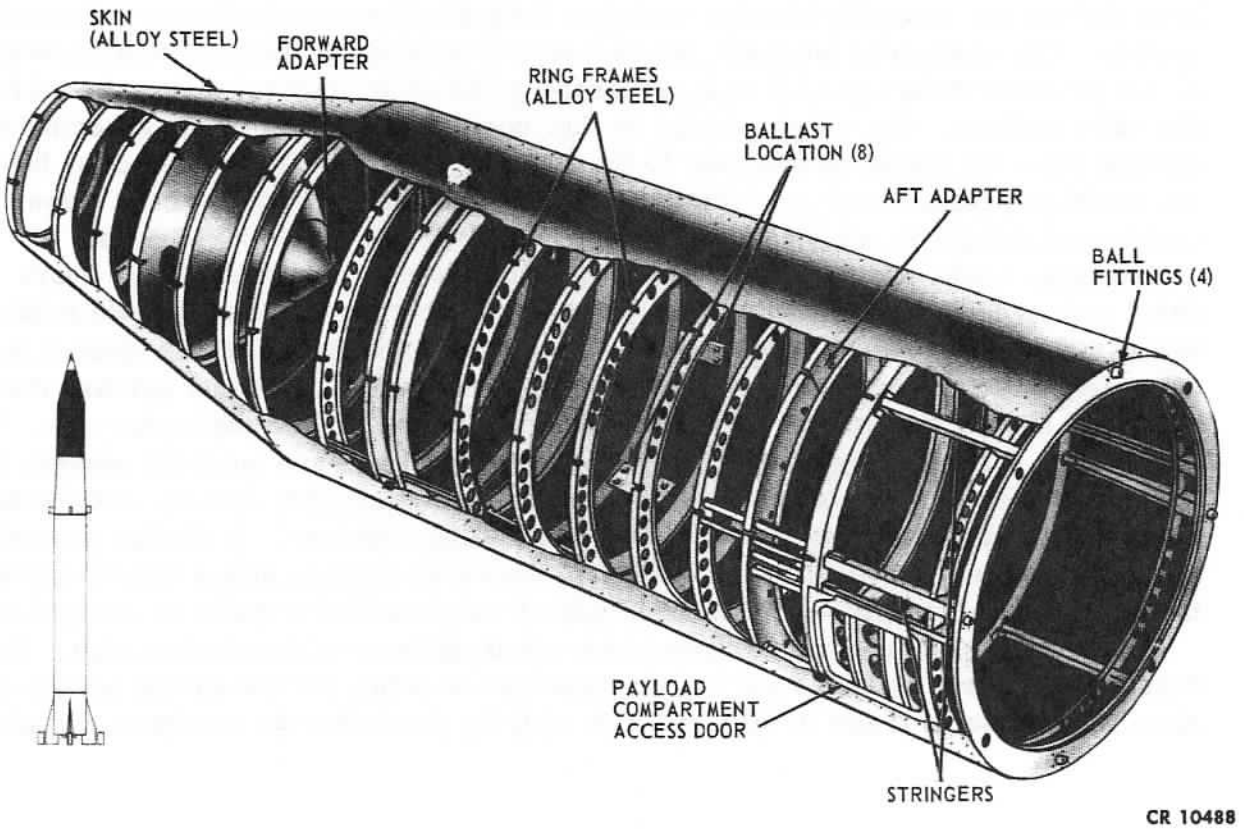

Figure II-4 – Nose Unit

There are four ball fittings on this former ring that locate and align the nose to the aft unit. These fittings accept the attaching bolts that pass through the first ring frame of the aft to hold the assemblies together. Four additional attaching bolts that do not seat in ball fittings are used at this point. A silicone rubber gasket is fitted between the nose and aft unit to assure airtightness.

Two doors located in the aft end of the nose unit provide access to the payload compartment aft bulkhead. These doors are also fitted with silicone rubber gaskets to assure an airtight fit.

AFT UNIT

The aft unit is a barrel-shaped structure that consists of an alloy steel skin riveted to a framework of aluminum ring frames and stringers. A reinforced pressure bulkhead divides the assembly into two sections: the instrument compartment and the skirt section. The instrument compartment is that portion of the aft assembly that is forward of the pressure bulkhead used to separate the guidance and control compartment from the skirt section. The skirt section is that open-ended portion of the assembly that extends from the pressure bulkhead to the last ring frame. The skirt section houses the two high-pressure air spheres that serve the body pneumatic systems. Four actuators which turn the air vanes are located in the aft end of the skirt section.

Two large doors provide access to the instrument compartment. These doors are fitted with silicone rubber gaskets to assure an airtight seal. The pressure bulkhead forms the aft end of the instrument compartment. An access door is located in the skirt section to provide access to equipment when the body and thrust unit are mated.

Six ball and socket fittings are used to align the body unit with the center unit. The ball fittings are located on the aft former ring of the aft unit, and meet six sockets riveted to the forward former ring of the center unit. Explosive screws are placed in tapped holes in the ball fittings to hold the assemblies together. A similar assembly, using four ball and socket fittings without the explosive screws, aligns the aft unit with the nose unit. At this junction a silicone rubber ring is added to make an airtight seal.

Four counterforts are located on the outer circumference of the skirt section. These counterforts serve as bases for the air vanes and housings for the spatial air jet nozzles. Counterforts II and IV also serve as striking plates for the expulsion cylinders.

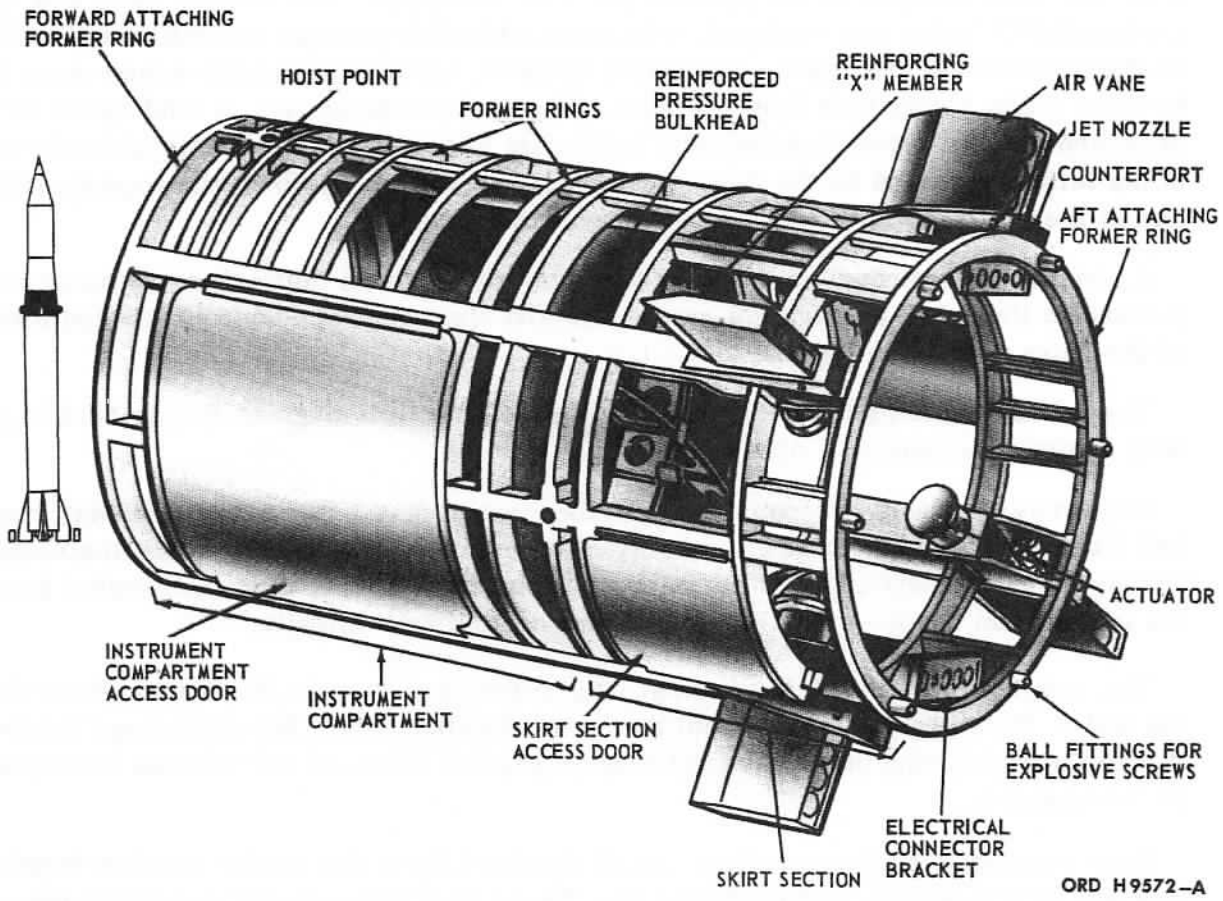

Figure II-5 – Aft Unit

CENTER UNIT

The propellants are carried in tanks that form the center unit. The center unit is fabricated of aluminum because it does not have to resist the effects of re-entry; this unit will have completed its mission prior to re-entry. The alcohol (alc) and liquid oxygen (LOX) tanks are designed to be pressurized to prevent cavitation and collapse as the propellants are used. Cavitation tends to occur when a high-speed pump tries to move fluids faster than they can flow. When cavitation occurs, a void space of low-pressure air exists between the inlet and outlet of the pump. Were cavitation to occur in the turbopump used on the missile, the pump could not perform the important function of metering the alc and LOX in correct proportions.

A conduit runs through both tanks to carry the general network cable harness and pneumatic lines that connect the pneumatic and electrical components located forward of the tanks with those located in the tail.

The aft bulkhead of the center unit is insulated with fiberglass that is held in place with a dummy bulkhead of aluminum.

The forward attaching former ring of the center unit has six sockets that receive ball fittings on the body to align and fasten the body to the thrust unit. Explosive screw access doors are located aft of the first ring frame and in line with each socket to allow the installation of the explosive screws from outside the missile.

The catwalk is fastened to the first ring frame and extends into the skirt section of the body. It is designed to protect the forward bulkhead and the equipment located on it while work is being performed in the skirt section after the missile has been erected on the launcher.

Four vane lock rod assemblies extend forward from the center section to join the four air vane lock rods in the aft section. These two parts are connected when the center and aft units of the missile are connected. The vane lock rods in the aft unit hold the air vanes in a fixed position until separation of the missile in flight. At separation, the vane lock rods are pulled from the four actuators in the aft unit and the air vanes are left free to operate.

The aft ring frame incorporates four steel pads to which the engine mount is bolted.

Twenty connecting brackets on the aft ring frame fasten the center unit to the tail unit.

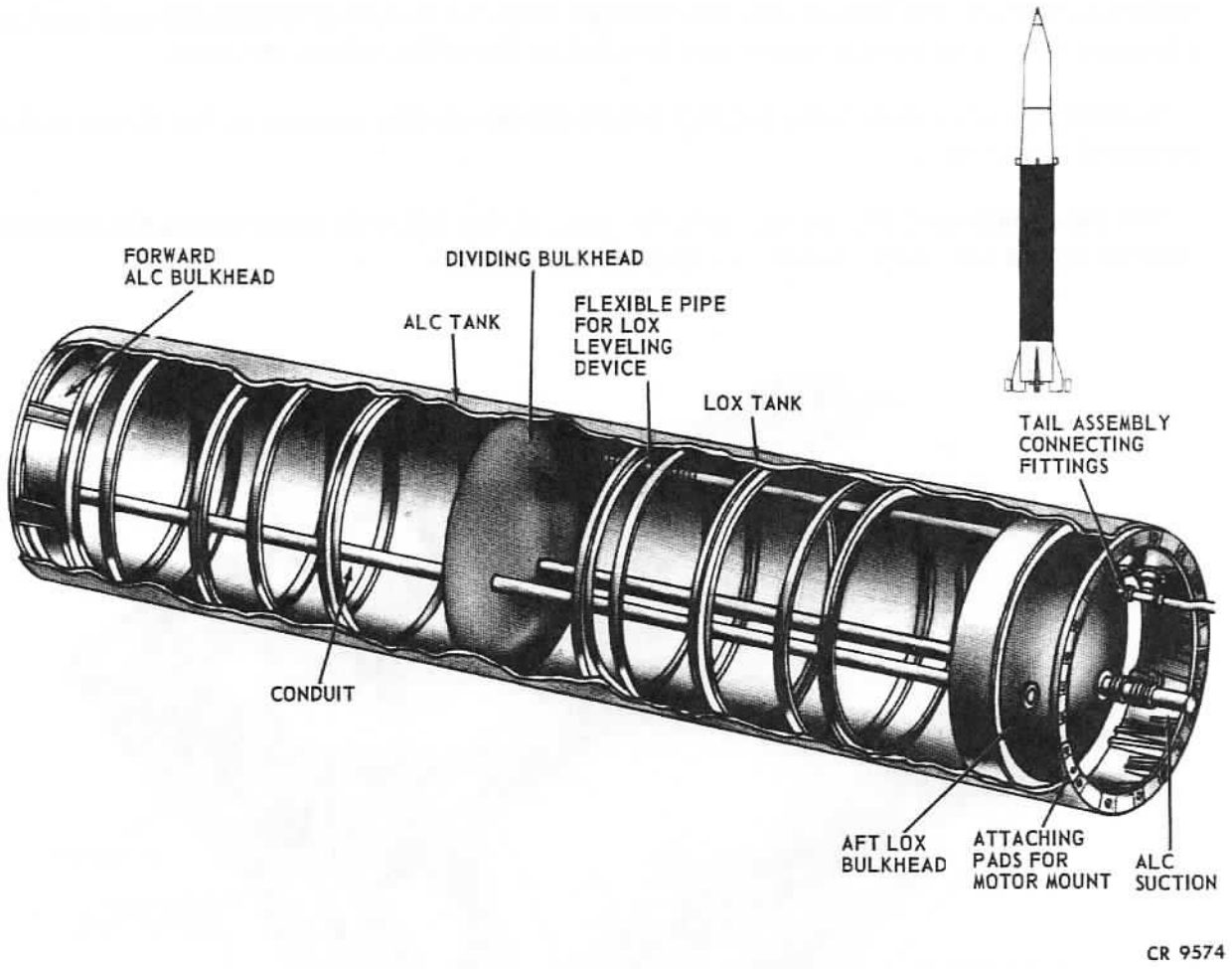

Figure II-6 – Center Unit

TAIL UNIT

The tail unit is a riveted aluminum structure that consists of four stabilizing fins mounted on a barrel-shaped housing. It is bolted to the aft former ring of the center unit after the propulsion unit has been fastened in place. The tail unit serves to shroud the propulsion unit and also provides control surfaces for the first phases of flight. In addition, the tail unit houses the air-storage spheres and other pneumatic and electrical components. Two access doors are located in the sides of the tail unit.

The high-pressure air spheres that serve the pneumatic system of the thrust unit are mounted in the tail.

Wiring harnesses are mounted on the side of the tail unit and connect the electrical system to the tail plugs located in fins II, III, and IV.

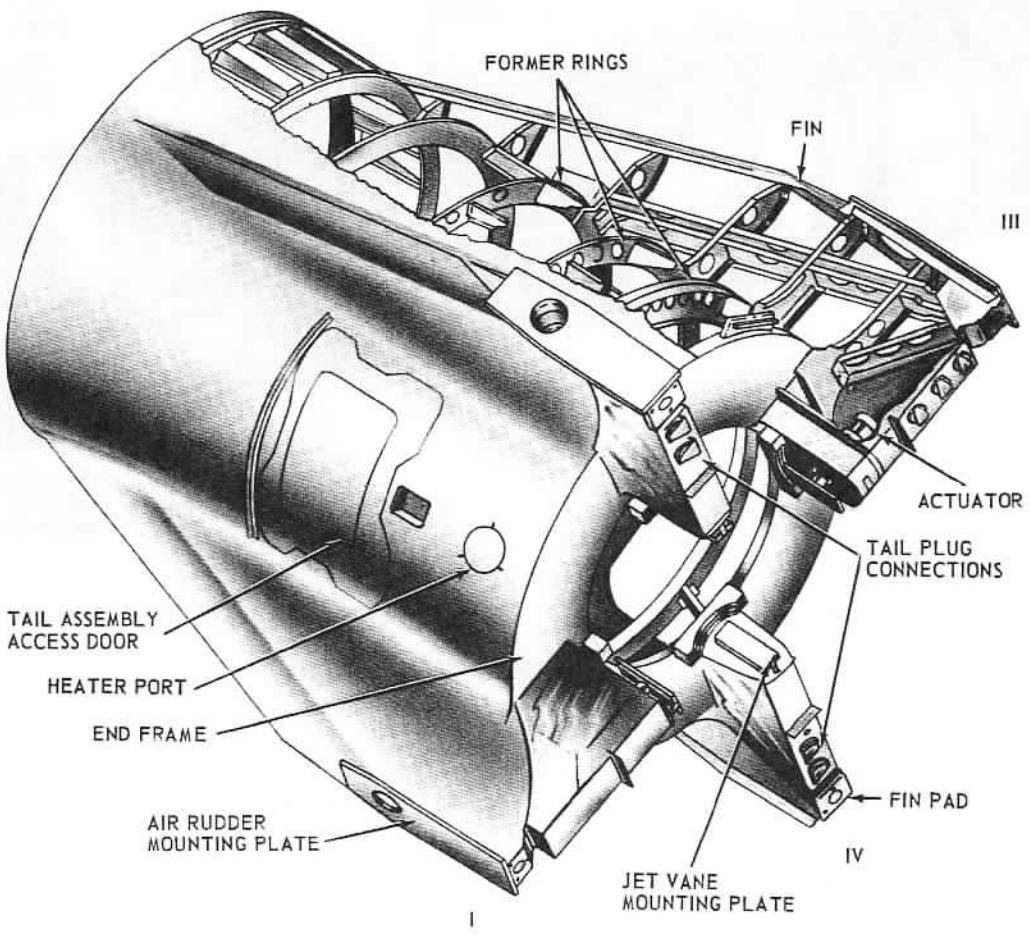

Figure II-7 – Tail Unit

Eight electrical connectors located in the stabilizing fins are used to connect the general electrical network on board the missile with the ground network. After the missile leaves the launcher at liftoff and the connections are broken, spring-loaded caps cover the ends of the connectors to protect them from the engine's exhaust gases.

The emergency cutoff connection is located in fin III.

All fin pads have locating holes for use in mounting the missile on the launcher.

The multiple pneumatic coupling connector is located in a balcony housing on the outside of the tail unit between fins II and III.

The LOX replenishing coupling is located in a similar balcony housing between fins I and IV.

If the missile is to be stored for any length of time, it is necessary to circulate air within the tail unit to prevent the formation of condensation. For this purpose, a hole is provided in the LOX replenishing balcony through which a duct may be inserted for air circulation.

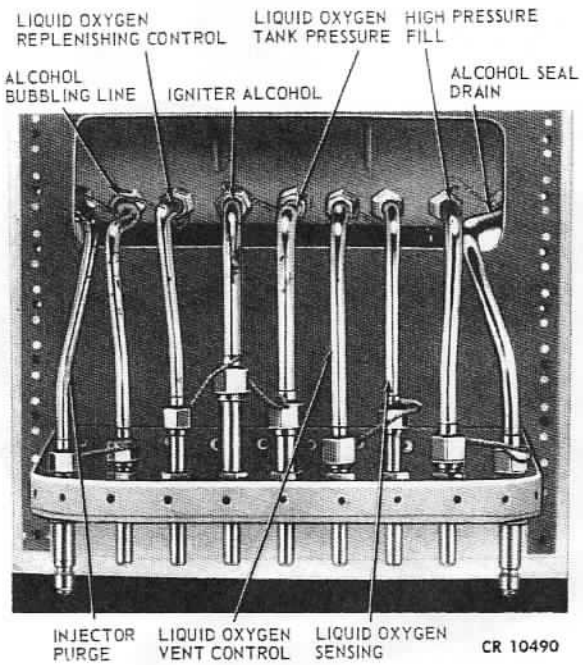

Figure II-8 – Multiple Pneumatic Coupling Balcony

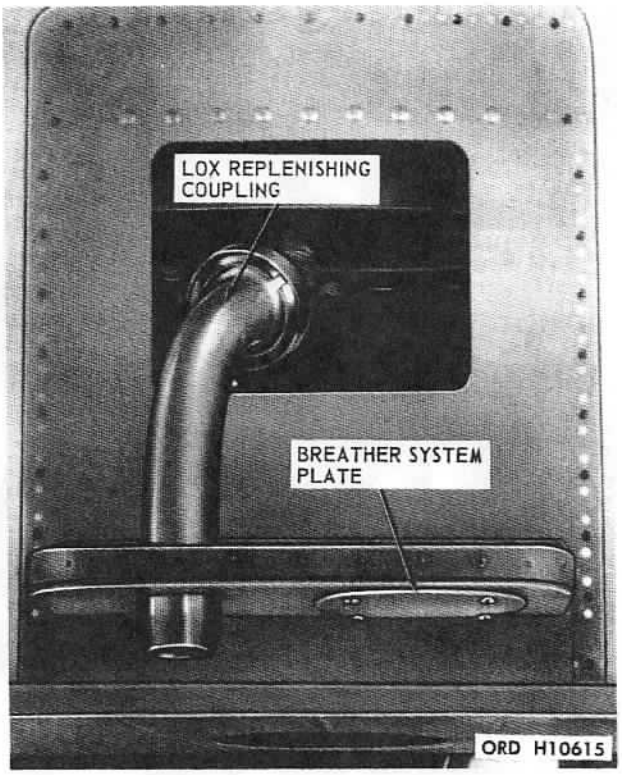

Figure II-9 – LOX Replenishing Coupling Balcony

ENGINE MOUNT

The engine mount is a welded frame of steel tubing that is bolted to the center unit. The mount transmits thrust produced by the engine to the aft ring frame of the center unit. Shims are used between the engine mount and the engine to align the engine. In addition to supporting the rocket engine, the engine mount is used to support the turbopump, the hydrogen peroxide tank, and other components that are related to the propulsion unit.

The engine is of the liquid-propellant, fixed-thrust type consisting of one thrust chamber producing 78,000 pounds nominal thrust. The engine is rated to deliver this thrust for a main-stage duration of 117 seconds. Fuel for the engine is a mixture of alcohol and water with liquid oxygen as the oxidizer. Cooling is accomplished regeneratively by using the alcohol fuel as a coolant. Fuel and oxidizer are delivered to the thrust chamber by a two-stage turbopump which drives the alc and LOX pumps. The turbopump is powered by steam generated through the reaction of hydrogen peroxide and potassium permanganate in the peroxide steam generator. The pumps deliver the propellants at the flow rates and pressures needed to maintain operation.

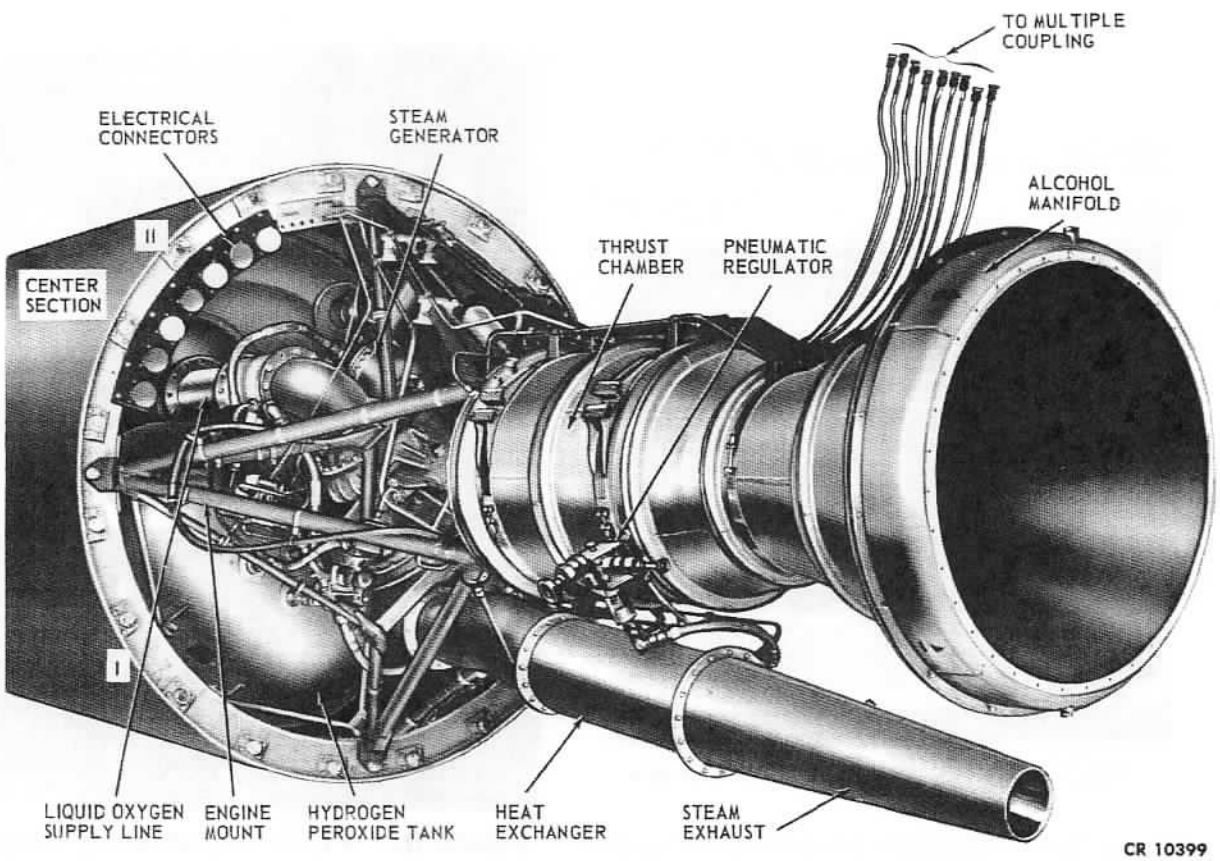

Figure II-10 – Engine Mount and Engine

CHAPTER III
GROUND SUPPORT EQUIPMENT

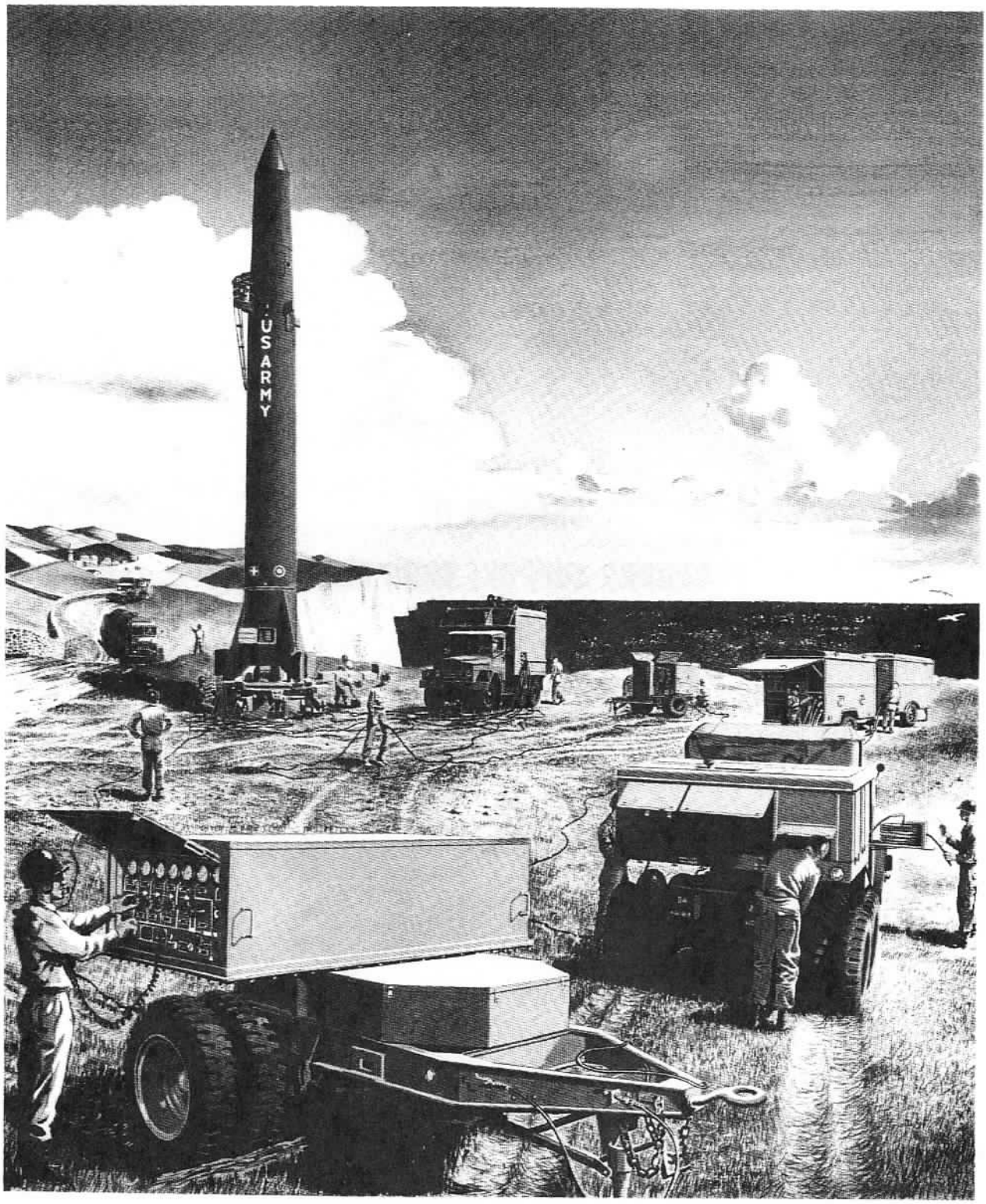

Figure III-1 – Mobile Launch Site

CHAPTER III
GROUND SUPPORT EQUIPMENT

GENERAL

Ground Support Equipment (GSE) includes all equipment used to transport, handle, test, service, and launch the missile.

One of the major advantages of the REDSTONE Missile System from a tactical and operational point of view is that this system is highly mobile. Mobility was a prime factor in the design and selection of equipment which also had to be rugged, easy to operate, and self-sufficient. The missile and all associated equipment can be transported by air, land, or sea.

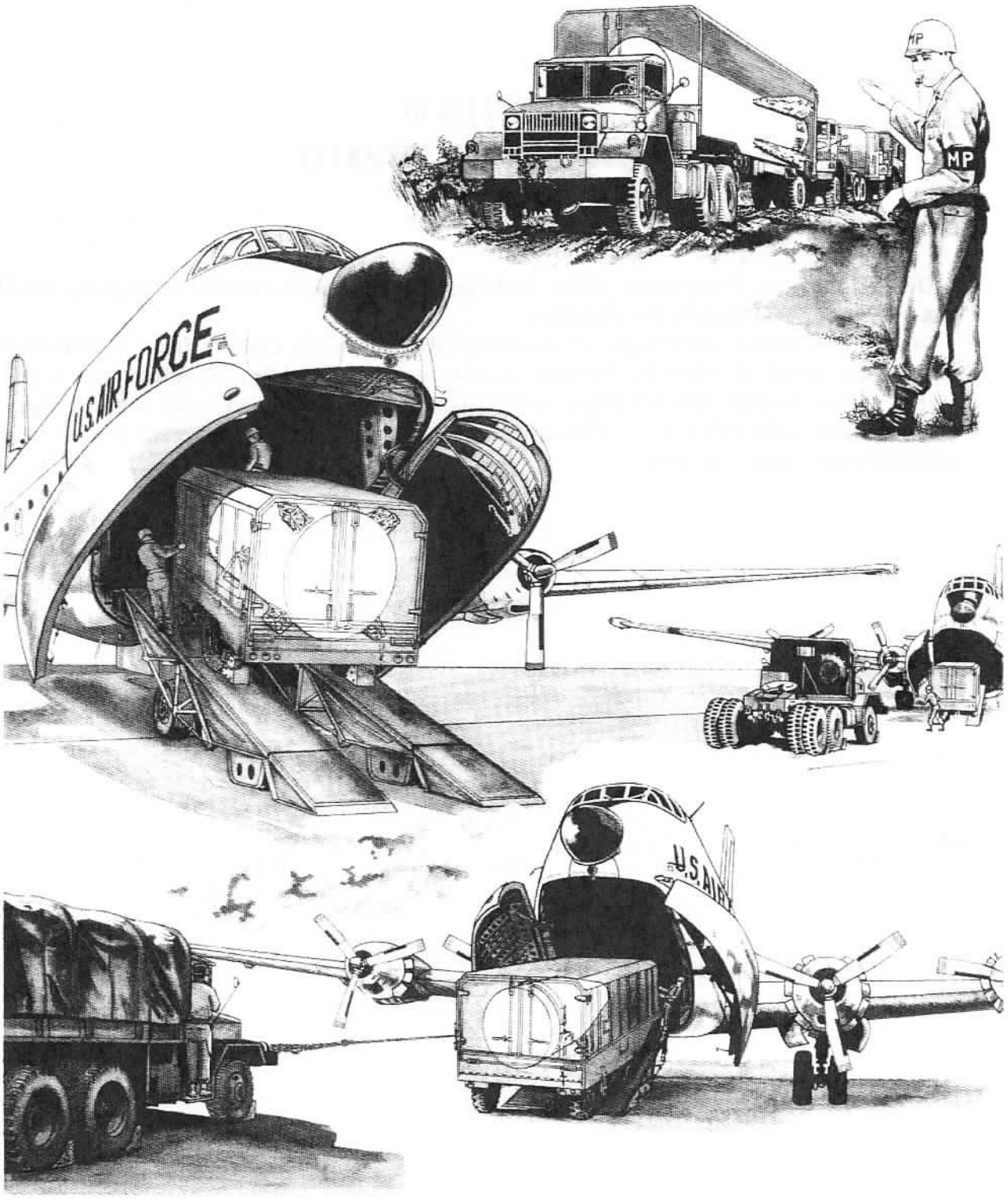

Figure III-2 – Loading for Shipment by Air

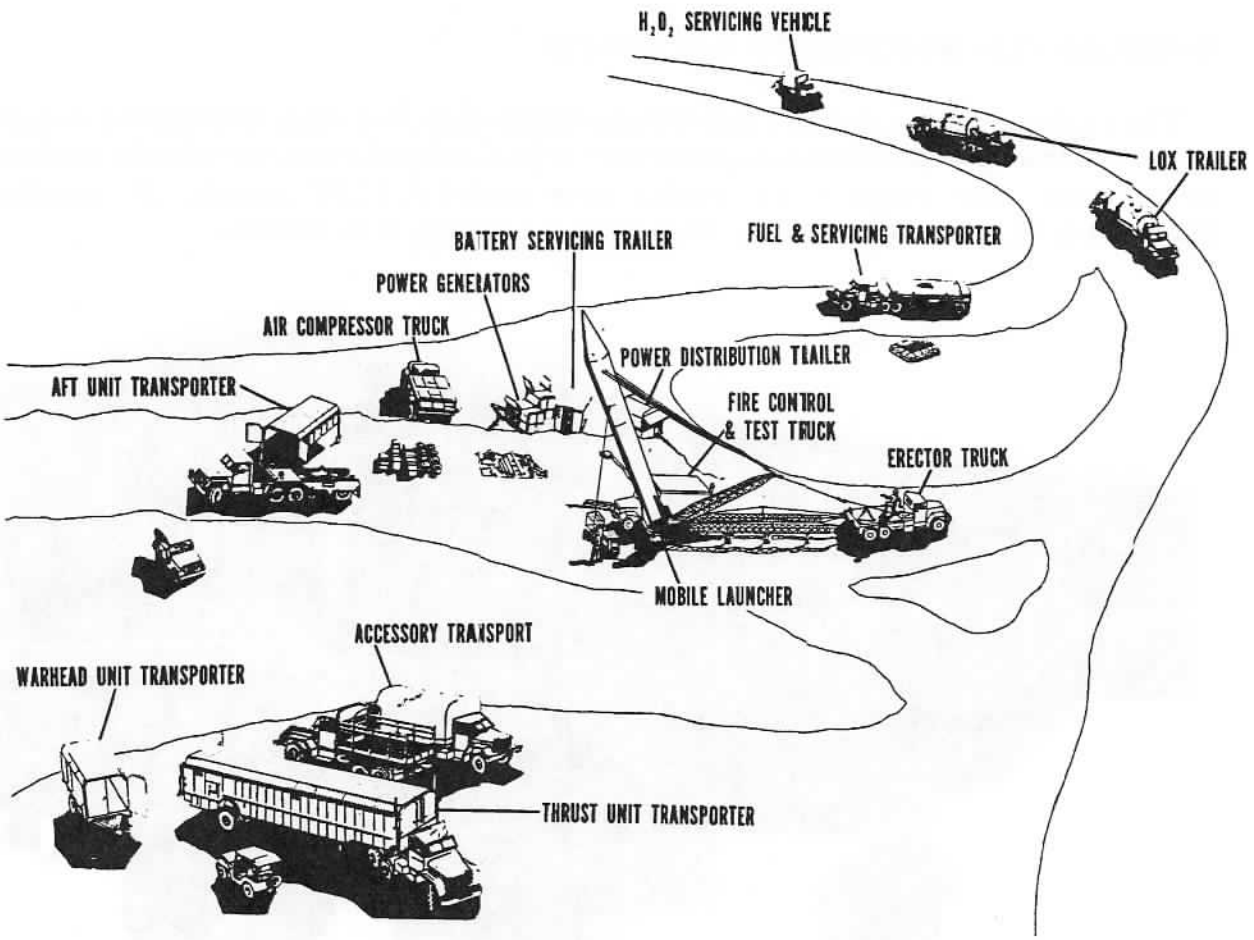

Figure III-3 – Field Deployment

WARHEAD UNIT SEMITRAILER VAN (XM481)

The warhead unit trailer is a two-wheel, single-axle, van-type semitrailer designed to provide transportation and storage for the warhead unit and small on-missile explosive accessories. The weight of the trailer when loaded is 17,660 pounds. It consists of base and cover assemblies and is towed by a 2 1/2-ton, 6 by 6 truck.

Figure III-4 – Warhead Unit Semitrailer (Left Side)

The base assembly is of standard frame construction and contains a rubber-lined saddle, a hold-down clamp, and bolt-receiver supports which secure the warhead unit while in transit. Four jacks equipped with casters are used to lift and remove the cover assembly from the trailer base. Three of the trailers are issued to each Ordnance Support Company and one to each Artillery Firing Battery.

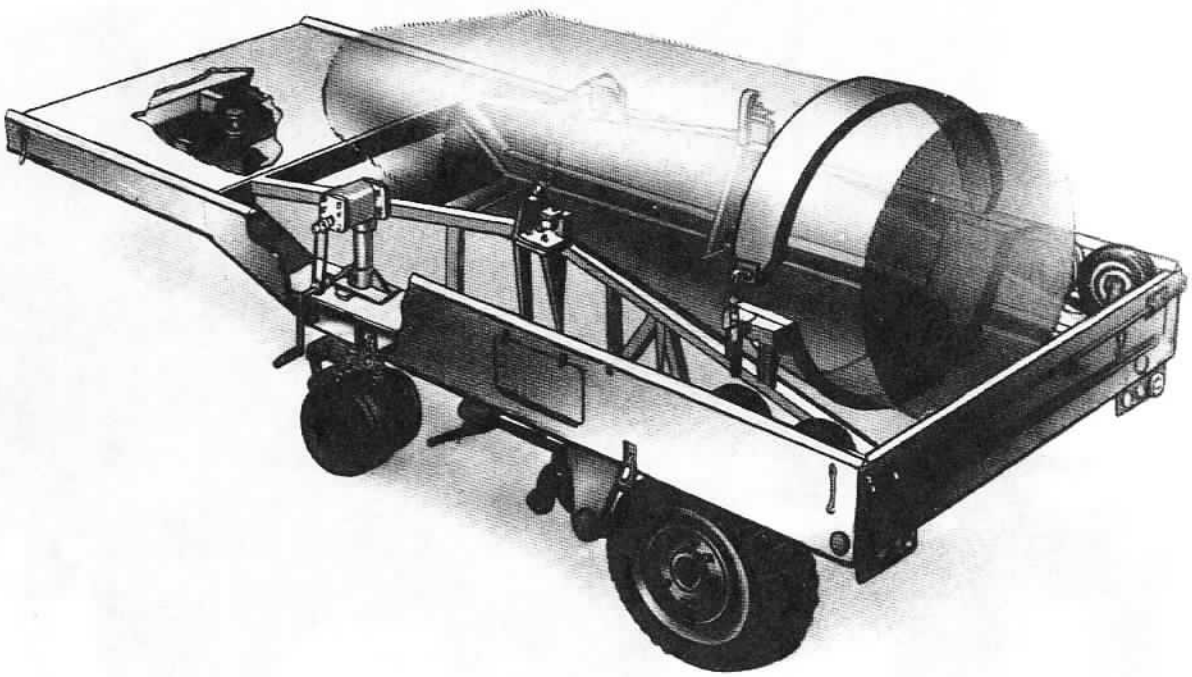

Figure III-5 – Base Assembly – Warhead Unit Trailer

AFT UNIT TRAILER (XM480)

The aft unit trailer is a two-wheel, single-axle, van-type trailer designed to provide transportation and storage for the aft unit and the heater-cooler assembly. This trailer weighs 6,360 pounds when loaded and consists of base and cover assemblies. It is towed by a 2 1/2-ton, 6 by 6 truck.

Figure III-6 – Aft Unit Trailer

The base assembly consists of a standard frame construction that contains a rubber-lined cradle and a hold-down band to secure the aft unit while in transit. The heater-cooler container is mounted on the trailer frame in front of the trailer bed. Four jacks equipped with casters are used to lift and remove the cover assembly from the trailer base.

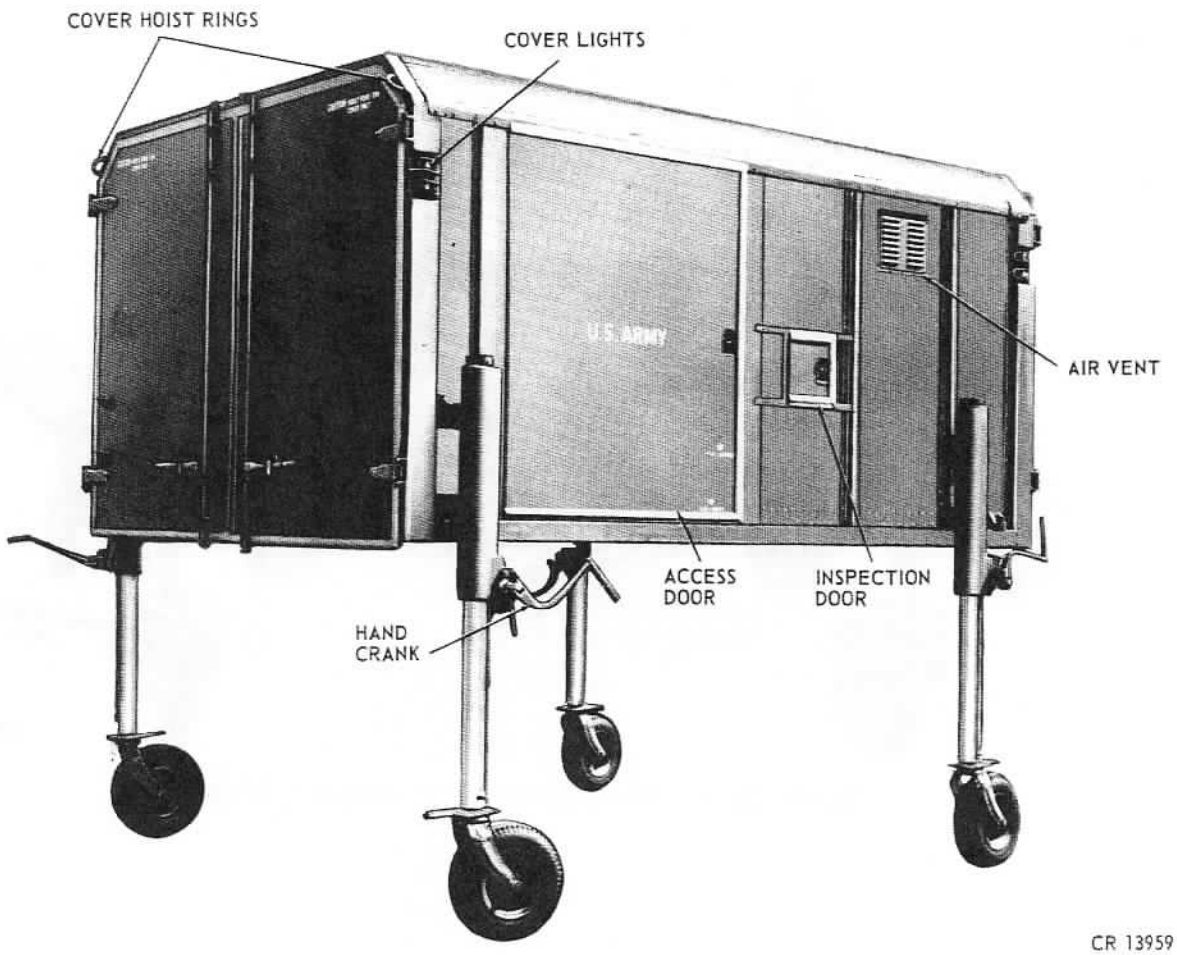

Figure III-7 – Cover – Aft Unit Trailer

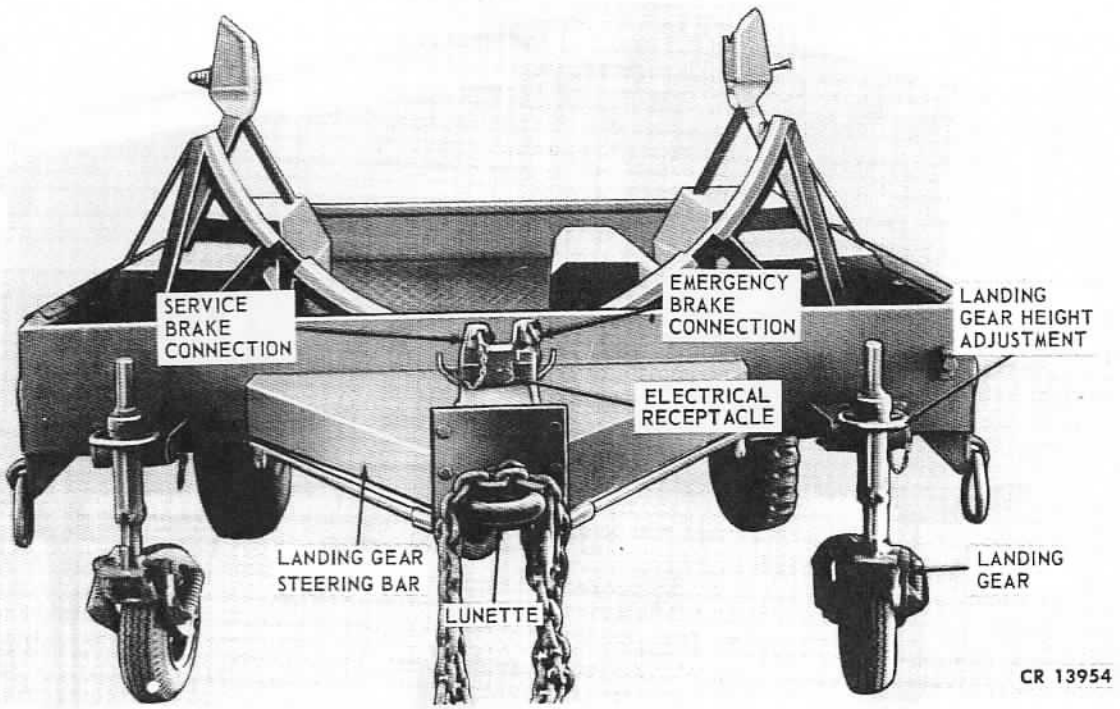

Figure III-8 – Base Assembly – Aft Unit Trailer

THRUST UNIT TRAILER (XM482)

The thrust unit trailer is a two-wheel, single-axle, van-type semitrailer designed to provide transportation and storage for the missile thrust unit and those missile components which are installed at the firing site. The weight of the trailer when loaded is 18,927 pounds. It consists of base and cover assemblies and is also towed by a 2 1/2-ton, 6 by 6 truck.

The base assembly is of standard frame construction and contains a rubber-lined saddle, a hold-down clamp, and bolt-receiver supports which secure the thrust unit while in transit. Four jacks equipped with casters are used to lift and remove the cover assembly from the trailer base. Three of the trailers are issued to each Ordnance Support Company and one to each Artillery Firing Battery.

Figure III-9 – Thrust Unit Trailer

Figure III-10 – Accessories Transportation Truck (Load A)

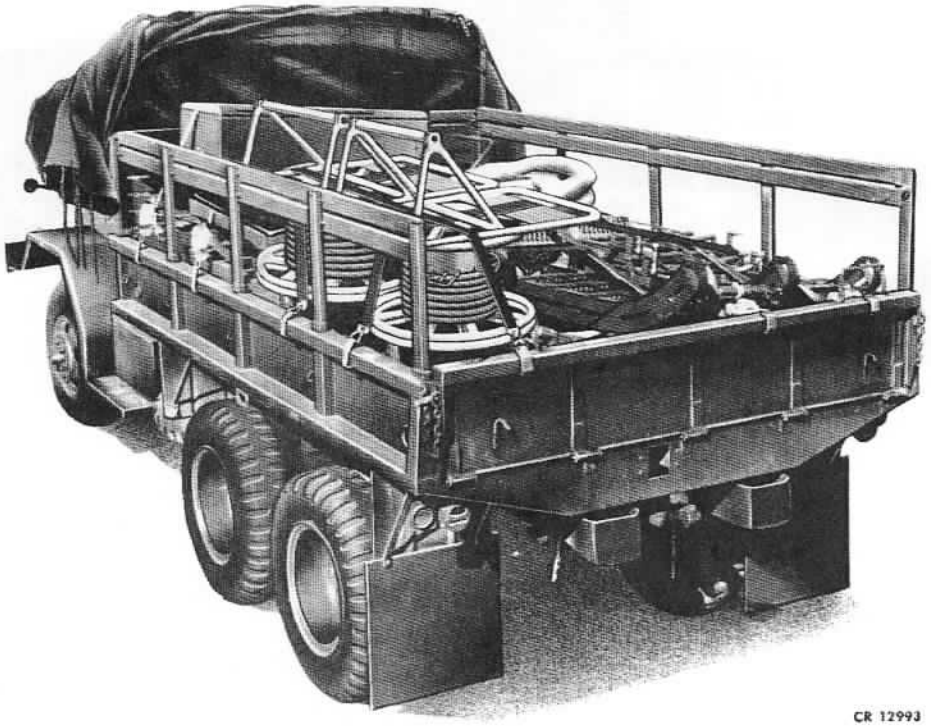

Figure III-11 – Accessories Transportation Truck (Load B)

ACCESSORIES TRANSPORTATION TRUCK

The accessories transportation truck is a 2 1/2-ton, 6 by 6, M35 vehicle used to transport loose equipment and the accessories necessary for missile assembly, check-out, and service at the launching site. This equipment consists of unpackaged accessories, packaged accessories, cable containers and cable reels. The truck weighs 18,540 pounds when loaded.

Two of these trucks are issued to each Ordnance Support Company and two to each Artillery Firing Battery.

ERECTOR-SERVICER (XM478)

The guided missile erector-servicer is a 2 1/2-ton, 6 by 6 truck modified to store and transport the A-frame, the H-frame, and the associated erecting and servicing equipment. This vehicle tows the platform launcher. It also provides power (through a 10-ton winch and a 1-ton electric hoist) for assembling and erecting the missile, for erecting the servicing platform, and for operating the personnel elevator.

One of these vehicles is issued to each Artillery Firing Battery.

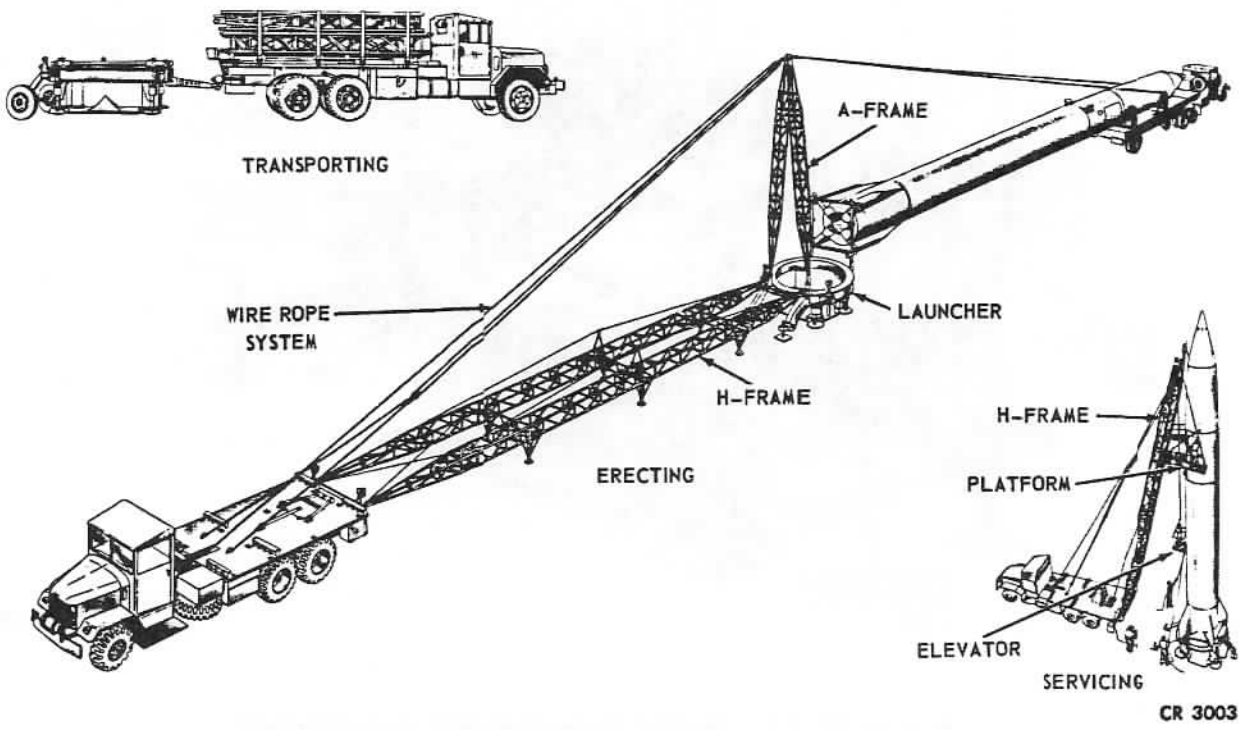

Figure III-12 – Erector Servicer

MOBILE PLATFORM LAUNCHER (XM74)

The platform launcher is a turntable affixed with two wheels. It is towed by the erector-servicer truck. This launcher provides a base for attaching electrical, pneumatic, and igniter-alcohol connections to the missile, and consists of a base, a deflection plate, a rotating frame assembly, outrigger support arms, and an axle.

Four two-speed jacks are used to support and level the platform launcher. Spirit levels located on the platform launcher at stations II and III are used to level the unit. The rotating frame assembly serves as a hinge during erection and as a support base for launching accessories.

One launcher is issued to each Artillery Firing Battery.

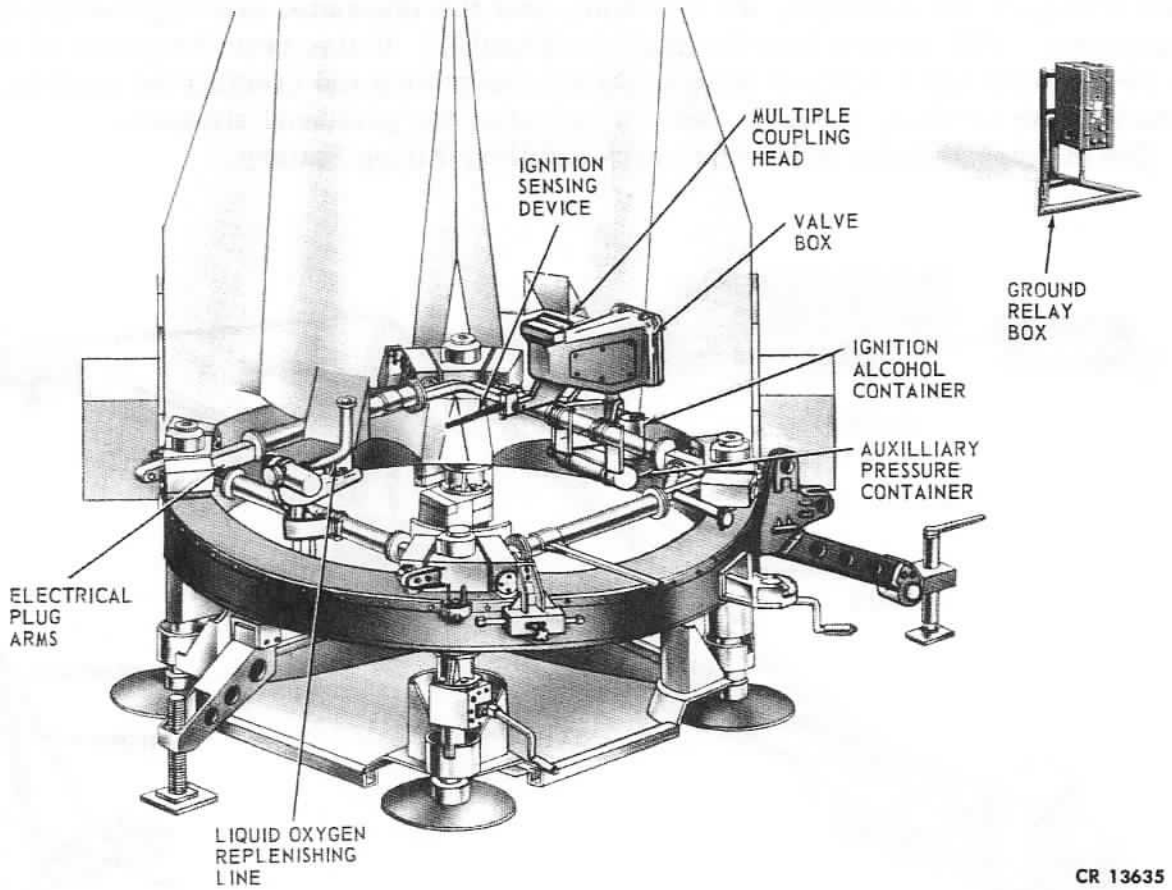

Figure III-13 – Mobile Launcher and Accessories

GUIDED MISSILE PROGRAMER TEST STATION (AN/MSM-38)

The guided missile programer test station is a 2 1/2-ton, 6 by 6 shop van modified to accommodate the personnel and equipment necessary to checkout the REDSTONE Missile. This truck weighs 16,731 pounds. Its primary purpose is to provide mobile facilities for testing certain on-missile components and for preparing the missile for flight by establishing predetermined trajectory data within the guidance system.

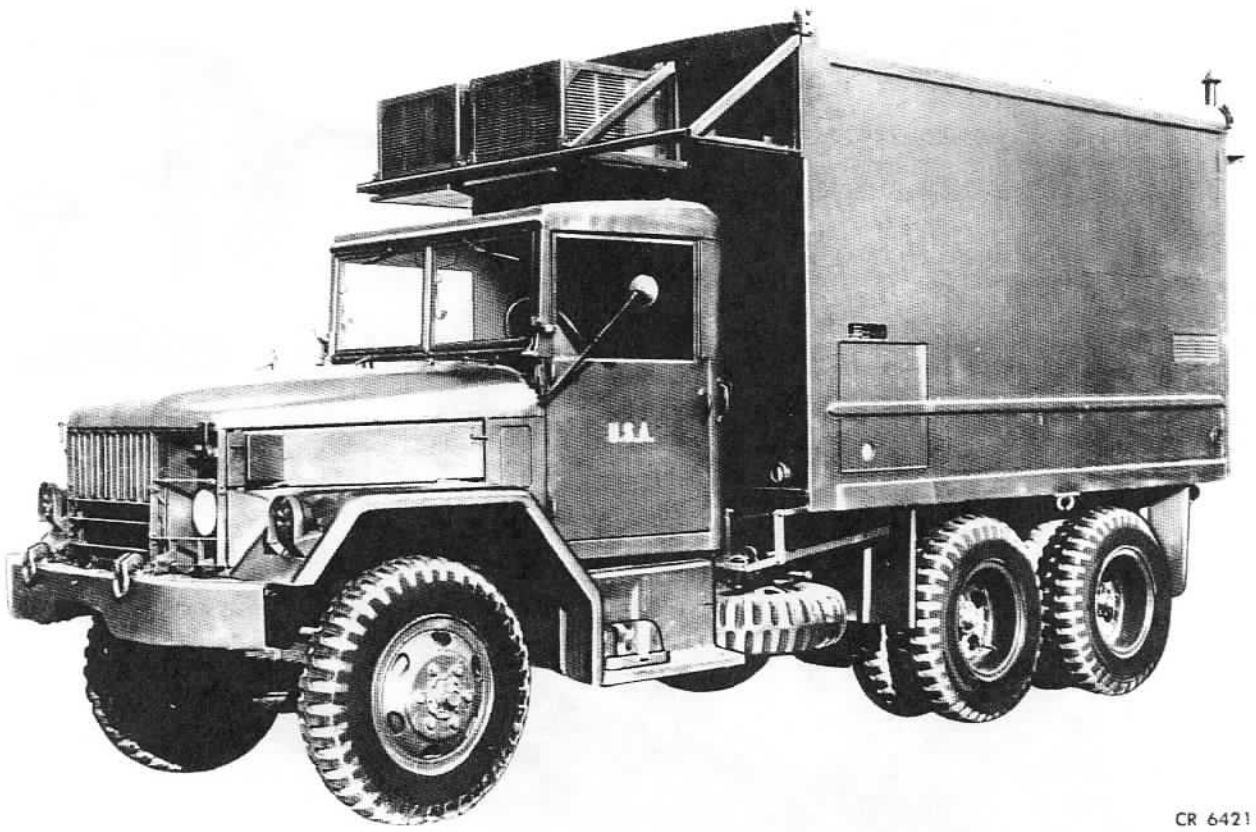

Figure III-14 – Guided Missile Programer Test Station (Exterior)

This van is divided into two sections: an operations room and a vestibule. These compartments are separated by a metal partition with a sliding door. At the rear of the van, there is a hinged platform which is used during loading and unloading. A detachable ladder is fixed to the platform for convenient access.

One vehicle is issued to the Ordnance Support Company and one to each Artillery Firing Battery.

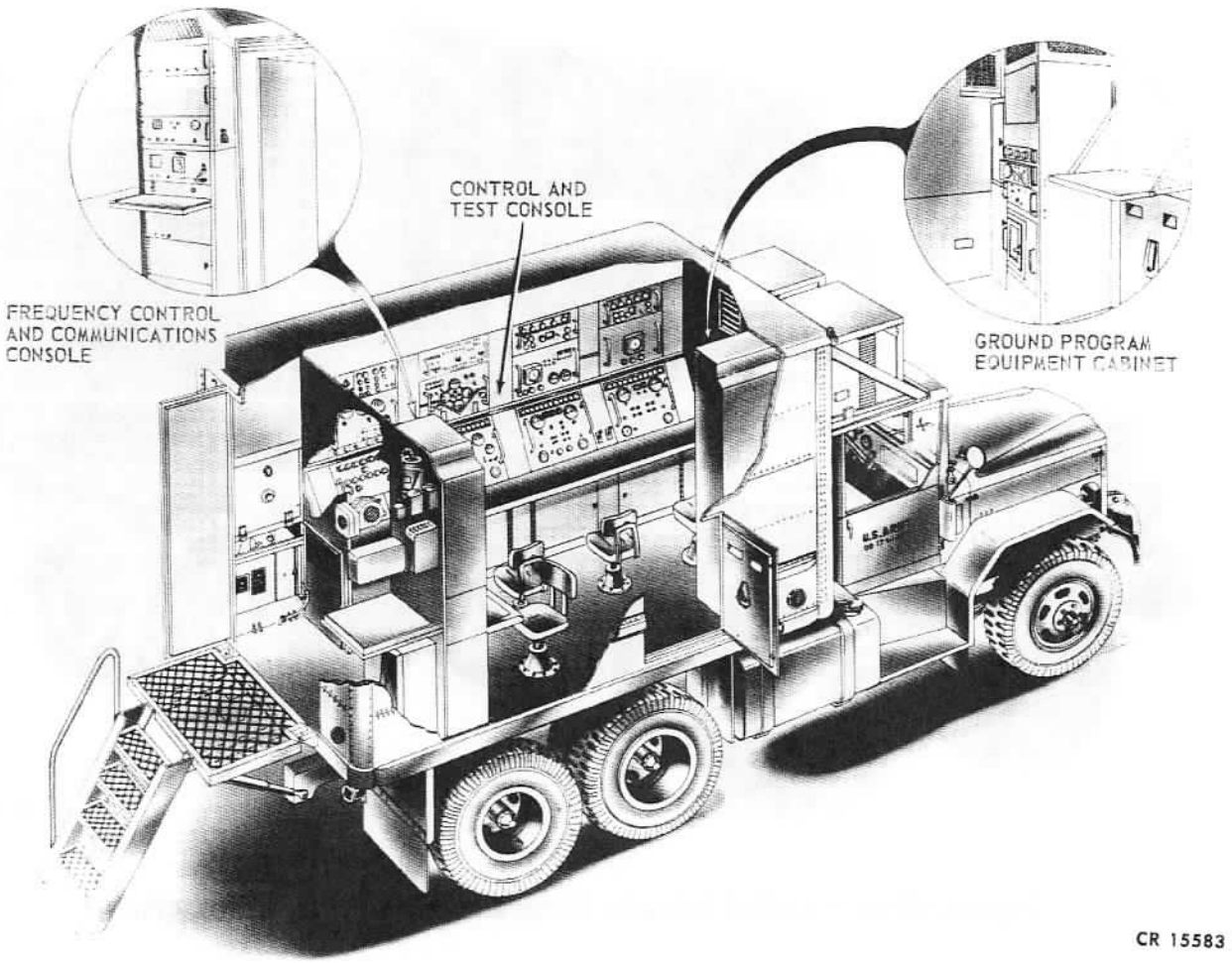

Figure III-15 – Guided Missile Programer Test Station (Interior)

GENERATOR SET

The generator set consists of a portable, diesel-driven, 60-kw generator and accessories mounted on a 3/4-ton, two-wheel trailer. The complete unit weighs 8,050 pounds when loaded. The generator provides power (120-volt, single-phase and 208-volt, 3-phase, 60-cps power) to the power distribution station.

One generator set is issued to the Ordnance Support Company, two to the Engineer Support Company, and two to each Artillery Firing Battery.

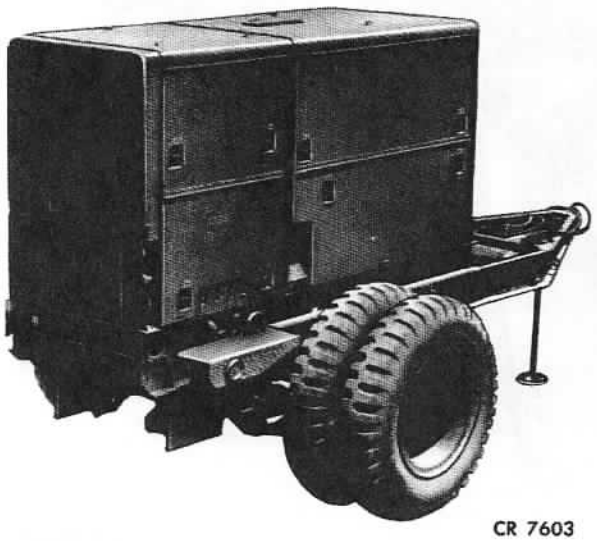

Figure III-16 – Generator Set

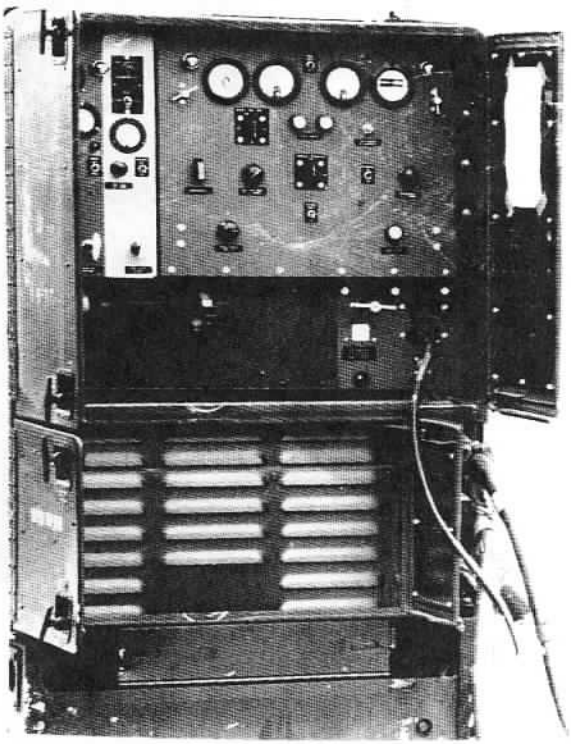

Figure III-17 – Generator Console Panel

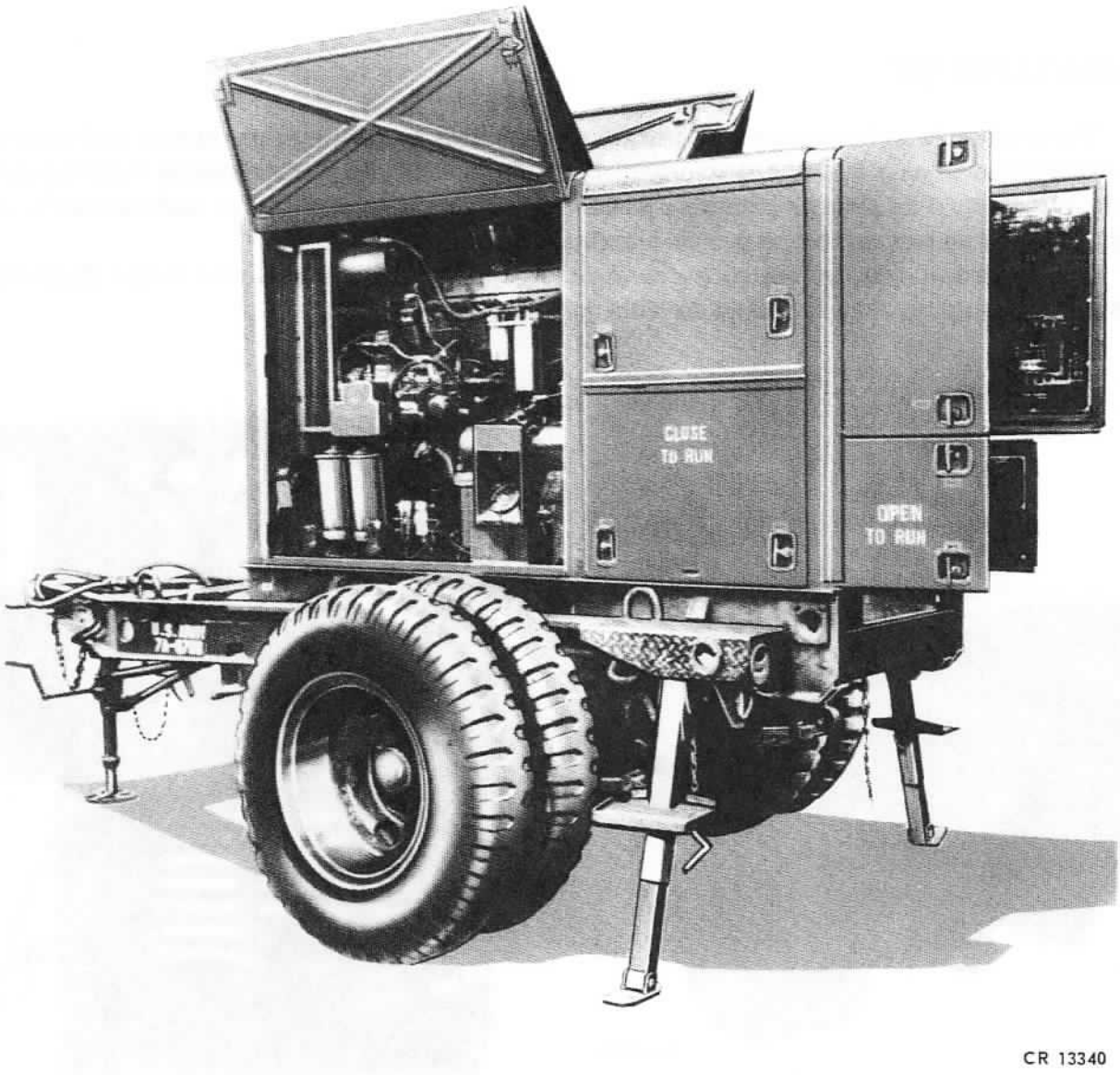

Figure III-18 – Generator Motor Compartment

POWER DISTRIBUTION STATION (AN/MSQ-32)

The power distribution station is a 3/4-ton, two-wheel trailer that weighs 2,400 pounds when loaded. This trailer receives electrical power from the generator trailer, converts this power to usable voltage and frequencies, and distributes the power to the other ground equipment and to the REDSTONE Missile. The body of the power distribution station is so constructed that the upper body shell, sides, ends, and top can be removed as a unit.

Inverters, energizers, a power control console, and a junction box are permanently mounted in the power distribution station.

One station is issued to the Ordnance Support Company and one to each Artillery Firing Battery.

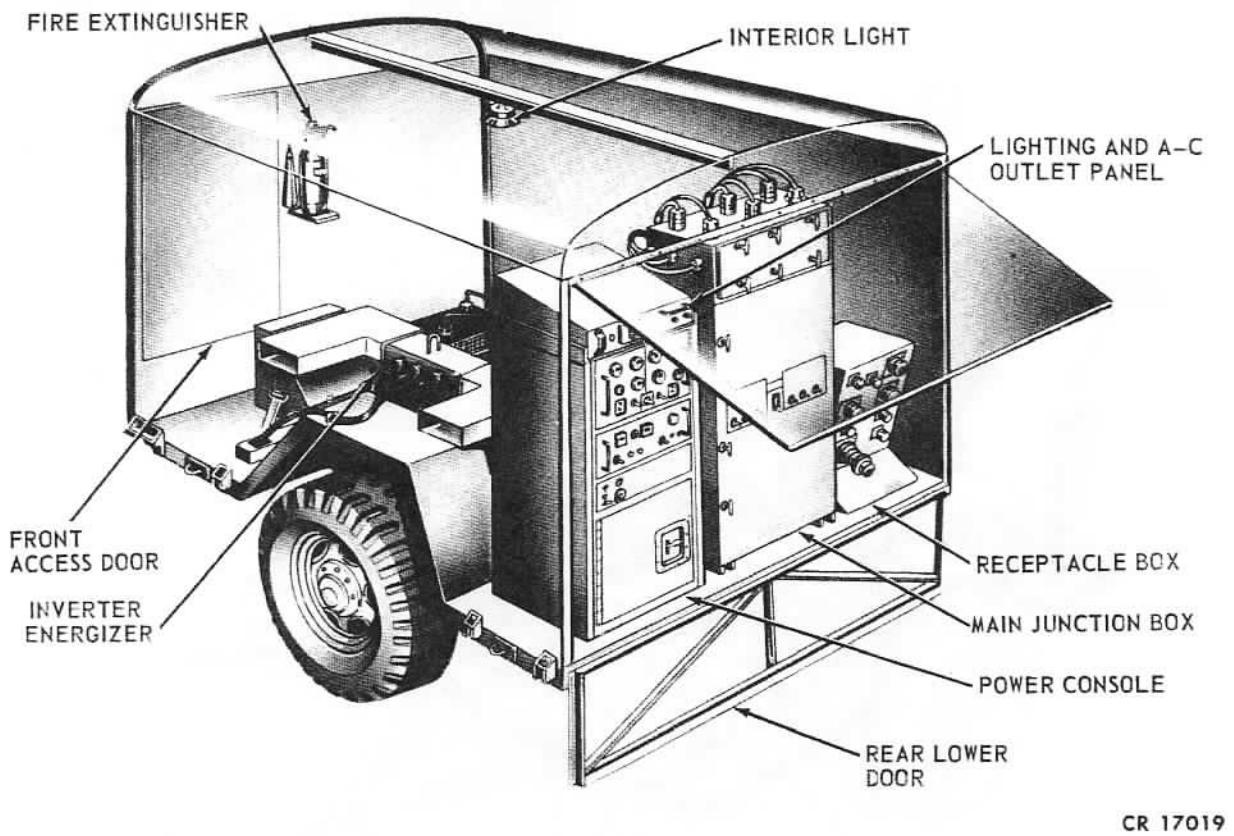

Figure III-19 – Power Distribution Trailer (Left Front View)

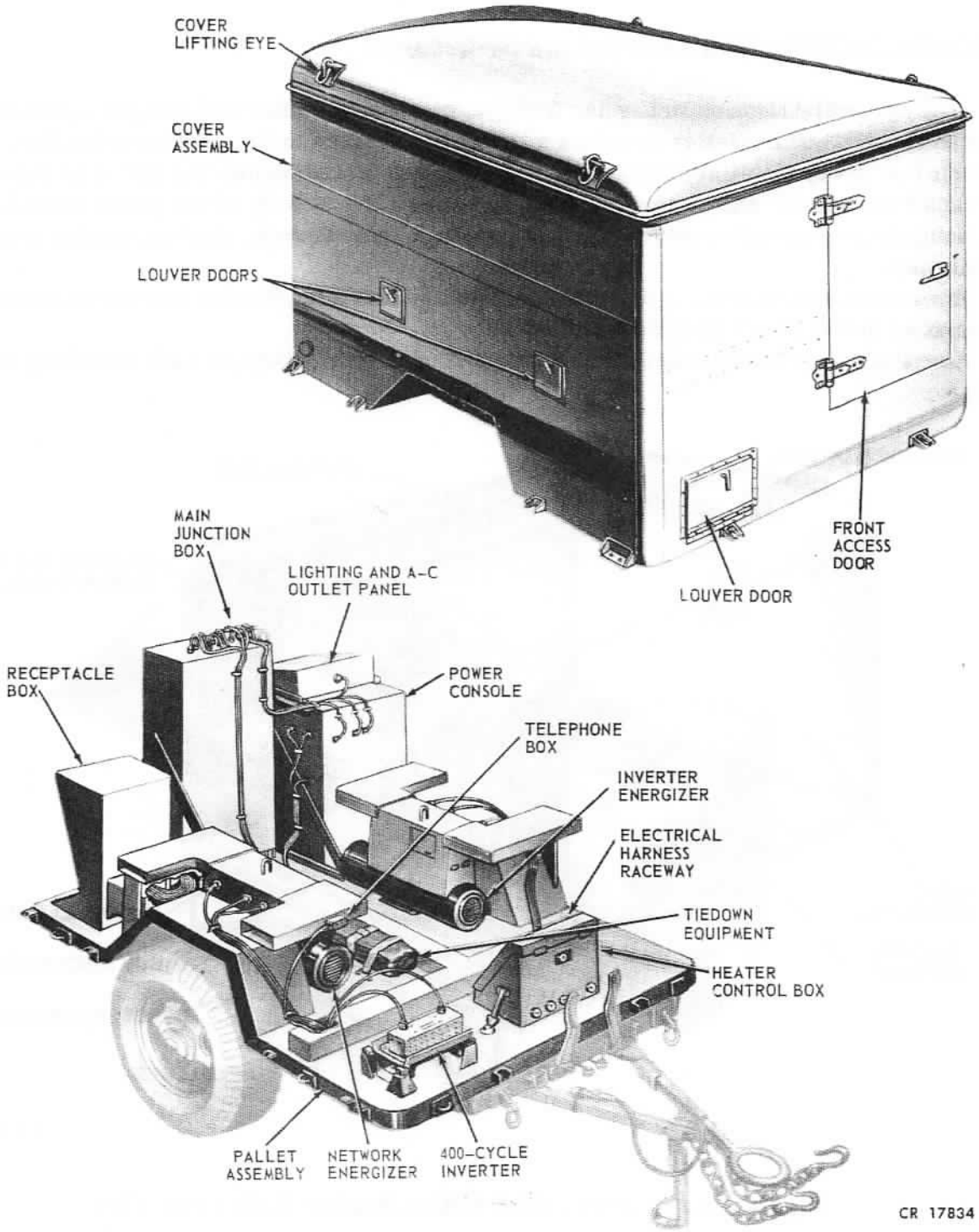

Figure III-20 – Power Distribution Trailer – Trailer Body (Right Front View)

BATTERY SERVICING SHOP (XM479)

The battery servicing shop is a 3/4-ton, two-wheel trailer designed to store and transport the missile batteries, the battery service and test equipment, and other accessories to the launching site. The battery servicing shop is enclosed by a sheet-metal housing assembly secured to a chassis. The housing assembly contains the equipment used to activate and service the missile batteries prior to launching. The entire unit weighs 2,050 pounds when loaded.

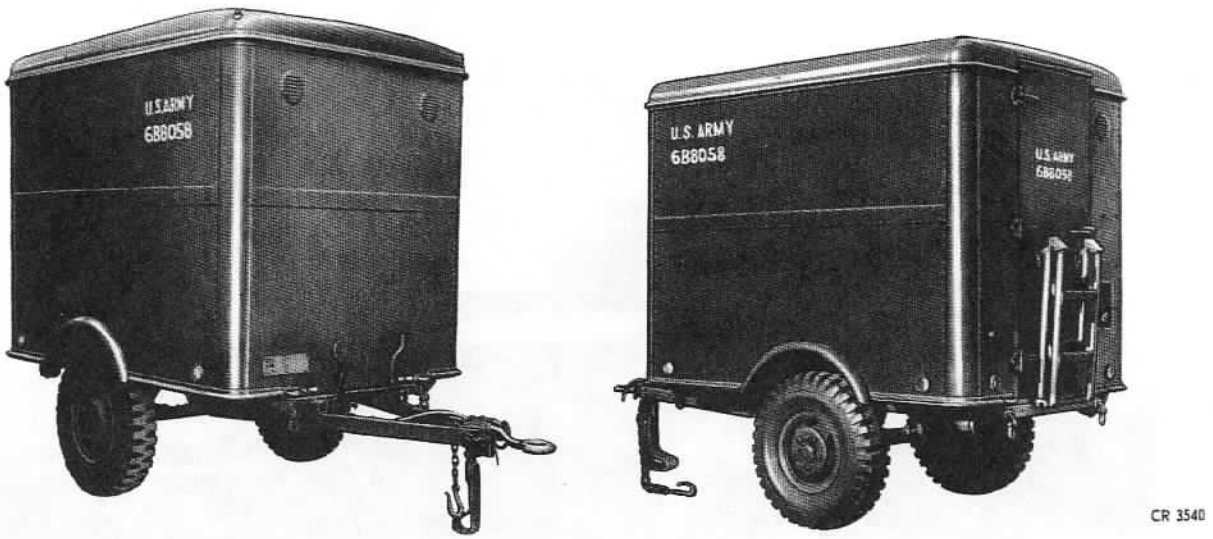

Figure III-21 – Battery Servicing Trailer

DELETED

AIR COMPRESSOR TRUCK

The air compressor truck is a 2 1/2-ton, 6 by 6 vehicle that contains and transports the air compressor, the air pressure regulating system, and accessory equipment. The air compressor is a reciprocating, power-driven, air-cooled unit designed to provide air pressure to the air servicer for testing and pressurizing the REDSTONE Missile. The vehicle weighs 18,540 pounds.

One compressor is issued to the Ordnance Support Company and one to each Artillery Firing Battery.

Figure III-22 – Air Compressor Truck

AIR SERVICER (XM483)

The air servicer is a 3/4-ton, two-wheel trailer designed to function as an air reservoir to assure a continuing air supply at periods of peak demand. The trailer consists of a metal container assembly secured to a chassis. The container assembly houses the air storage battery, air lines, hoses, and miscellaneous components. The complete unit weighs 7,021 pounds.

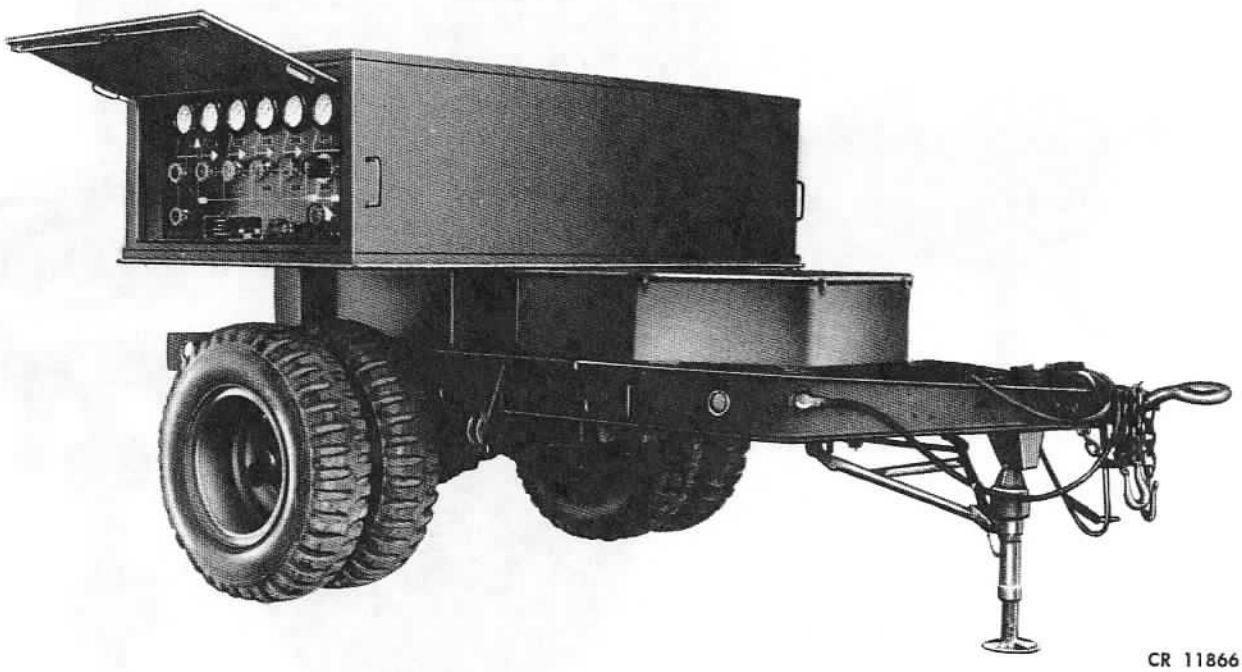

Figure III-23 – Air Servicer, Right Front 3/4 View

The air storage battery is a self-contained unit secured to a subchassis. Regulators, valves, connecting pneumatic lines, and air bottles are contained in this unit. The pneumatic system includes two panels with mounted controls to vent and monitor the pressurized air.

Issued to Ordnance Support Company and Artillery Firing Battery.

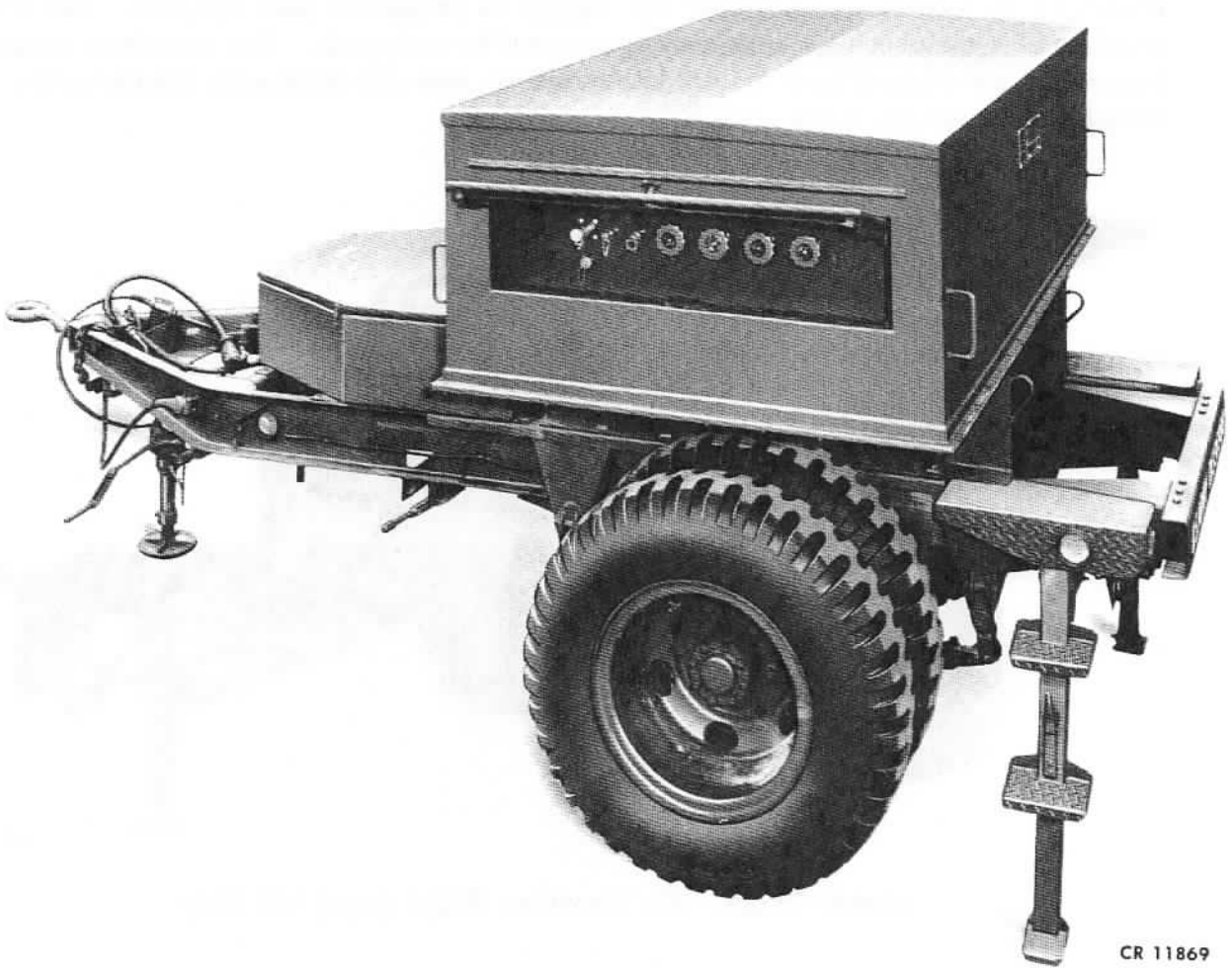

Figure III-23 – Air Servicer, Left Rear 3/4 View

ALCOHOL TANK SEMITRAILER (XM388)

The alcohol tank semitrailer is a two-wheel, 3,000-gallon, tank-type vehicle designed to transport fuel from the storage area to the launching site, and to fill, recirculate, or drain fuel as required at the launching site. The alcohol semitrailer consists of an elliptical, single-compartment tank, an undercarriage, a pumping compartment and a heater system. The fuel-transfer equipment is located at the rear of the tank and provides for metering, filtering, and transferring the fuel to the missile. A 5-ton, 6 by 6, M-52 tractor truck serves as the prime mover for the alcohol semitrailer. The semitrailer weighs 24,300 pounds when loaded.

Three are issued to the Ordnance Support Company and one each to the Artillery Firing Battery.

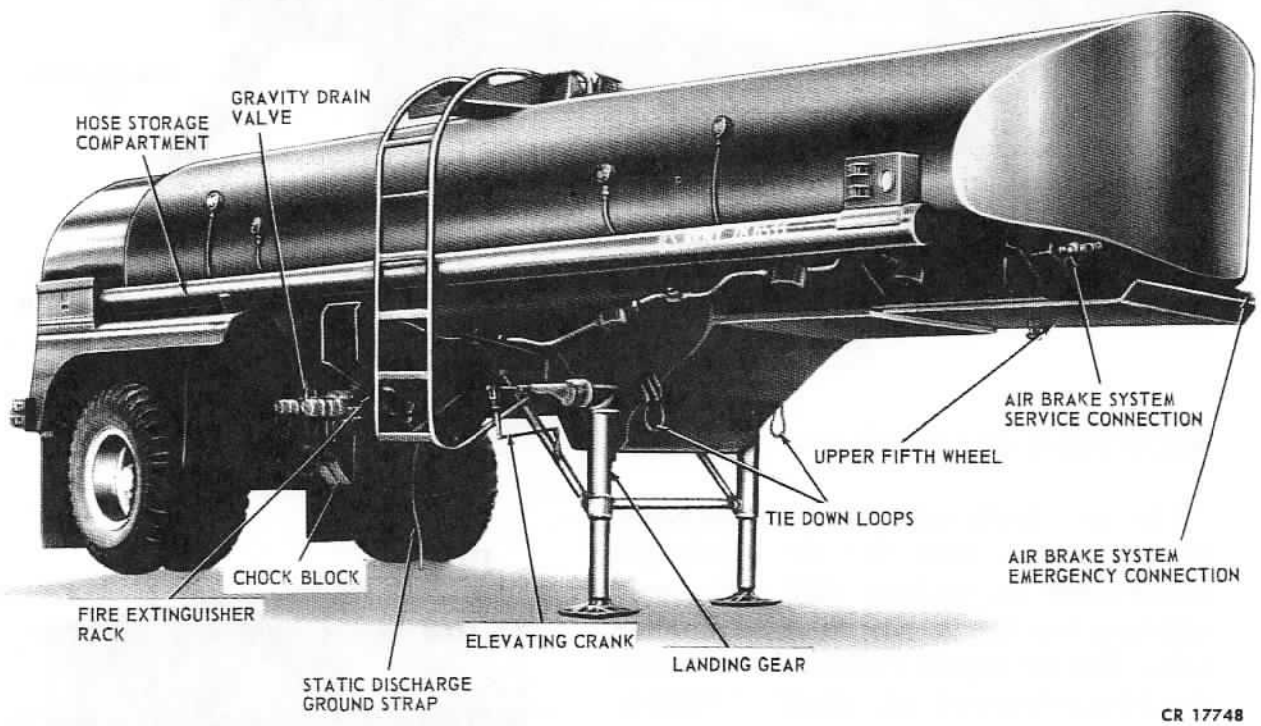

Figure III-24 – Alcohol Tank Semitrailer

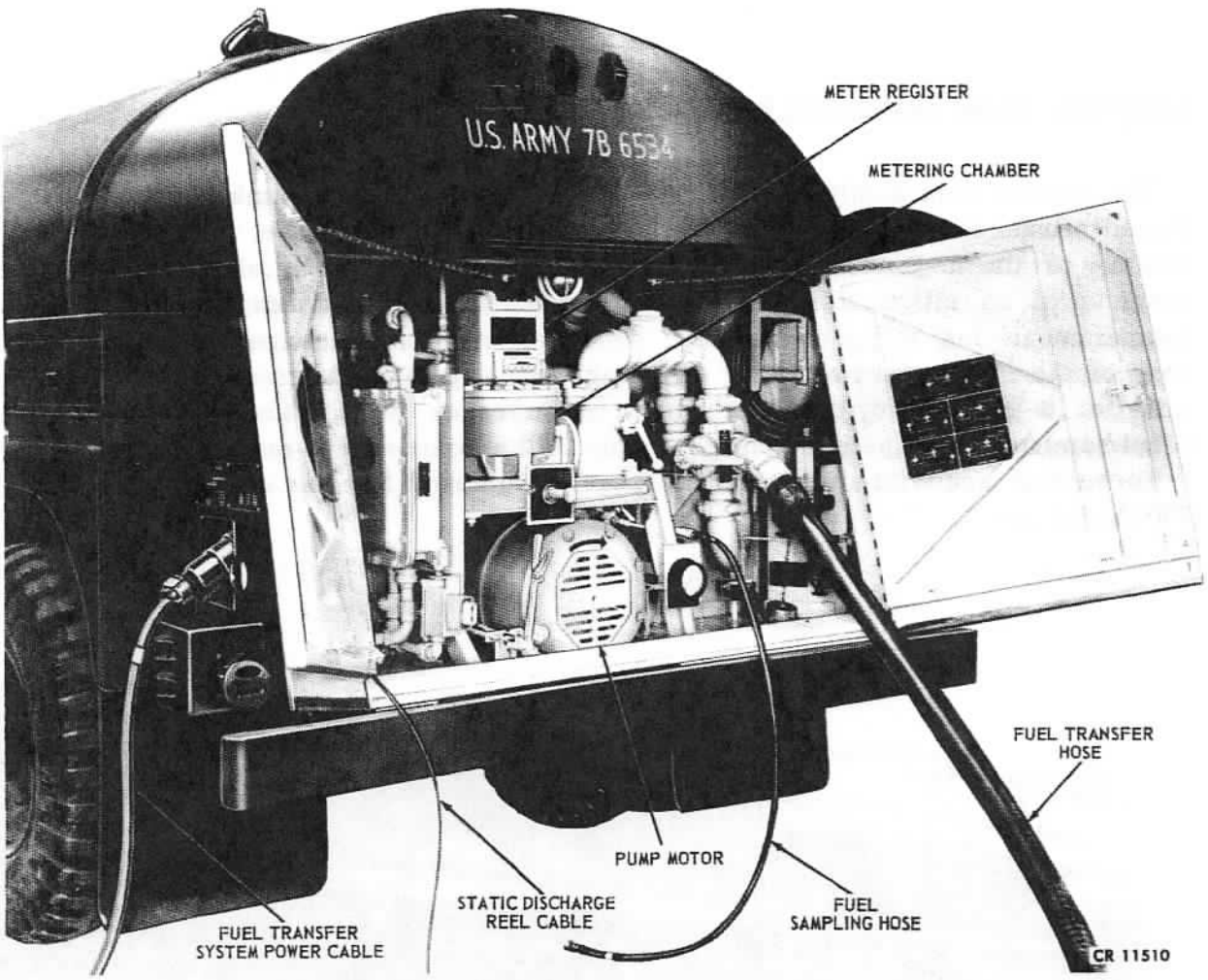

Figure III-25 – Pumping Compartment

AIR SUPPLY SEMITRAILER

The air supply semitrailer is operated in conjunction with the air separation semitrailer to produce LOX and liquid nitrogen for use in the REDSTONE Missile. The air supply semitrailer contains the compressed air supply assembly powerplant, powered by four diesel engines, that drives four 4-stage air compressors. This semitrailer is towed by a standard M-52 tractor truck.

Three semitrailers are issued to the Engineer Support Company.

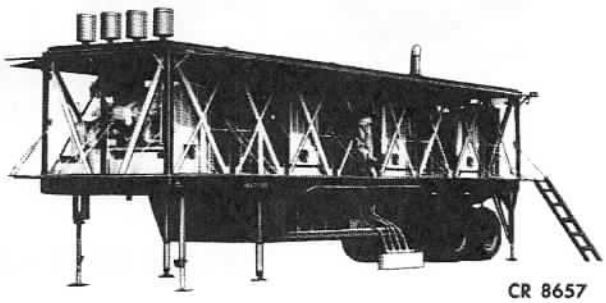

Figure III-26 – Air Supply Semitrailer

AIR SEPARATION SEMITRAILER

The air separation semitrailer is operated in conjunction with the air supply semitrailer to produce LOX and liquid nitrogen for use in the REDSTONE Missile. The air separation semitrailer contains the oxygen-nitrogen separation assembly consisting of a heat exchanger, air dryers, refrigeration system, a distillation column and an electrical generator. This semitrailer is towed by a standard M-52 tractor truck.

Three semitrailers are issued to the Engineer Support Company.

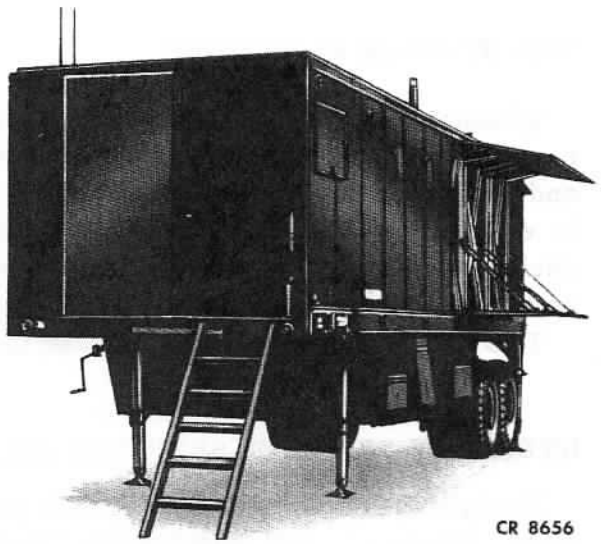

Figure III-27 – Air Separation Semitrailer

LOX TANK SEMITRAILER

The LOX semitrailer is a two-wheel, tank-type vehicle with a LOX capacity of 9 tons. It is designed to transport LOX from the storage area to the launching site, and to transfer LOX to the REDSTONE Missile. The LOX transfer equipment is mounted in a closed compartment at the rear of the tank. Initial filling of the missile tanks at the launching site and final topping to replace evaporation losses are accomplished from the LOX semitrailers. A 5-ton, 6 by 6, M-52 tractor truck serves as the prime mover for the LOX semitrailer. This semitrailer weighs 35,640 pounds when loaded.

Figure III-28 – LOX Semitrailer

Twelve LOX semitrailers are issued to the Engineer Support Company and two to each Artillery Firing Battery.

LOX STORAGE CONTAINER

The LOX storage container is a low-pressure skid-mounted tank with a rated storage capacity of 70,000 pounds of LOX. The container is mounted on two steel I-beam skids and rests on a cradle that is welded to the outer shell of the container. The container is equipped with a pump and with separate fill and discharge connections located on each side of the control cabinet at the rear of the container. The empty container can be transported on a standard 25-ton, low-bed semitrailer.

Two of these containers are issued to the Engineer Support Company.

HYDROGEN PEROXIDE SERVICER (XM387)

The hydrogen peroxide servicer is a modified 3/4-ton, 4 by 4 truck designed to heat, store, transport, and transfer the hydrogen peroxide used in the REDSTONE Missile. A tarpaulin roof, supported by bows, covers the cargo compartment which contains a 78-gallon drum of hydrogen peroxide, a monorail, and chain hoist assemblies. The monorail assembly extends beyond the tailgate and serves as a track for the chain hoist for lifting and lowering the hydrogen peroxide drum. This servicer weighs 7,630 pounds when loaded.

One hydrogen peroxide servicer is issued to each Artillery Firing Battery.

BULK MATERIAL REPAIR PARTS TRUCK (XM486)

The bulk material repair parts truck is a modified 2 1/2-ton, 6 by 6 truck designed to store and transport general repair parts and special bulk items to the launch site. This truck is equipped with a detachable, corrugated, sheet-metal housing assembly, bin assemblies, and a vertical storage rack. The truck also contains the necessary facilities for properly storing odd-size repair parts.

One truck is issued to the Ordnance Support Company and four to the Engineer Support Company.

REPAIR PARTS TRUCK (XM488)

The repair parts truck is a modified 2 1/2-ton, 6 by 6 truck designed to store and transport standard and tray-size repair parts to the vicinity of the launching site. This truck is equipped with a detachable, corrugated, sheet-metal housing assembly, a 4-bay rack assembly, and an access ladder. The truck also contains the necessary facilities for properly storing repair parts carried in bin stock.

One of these trucks is issued to the Ordnance Support Company.

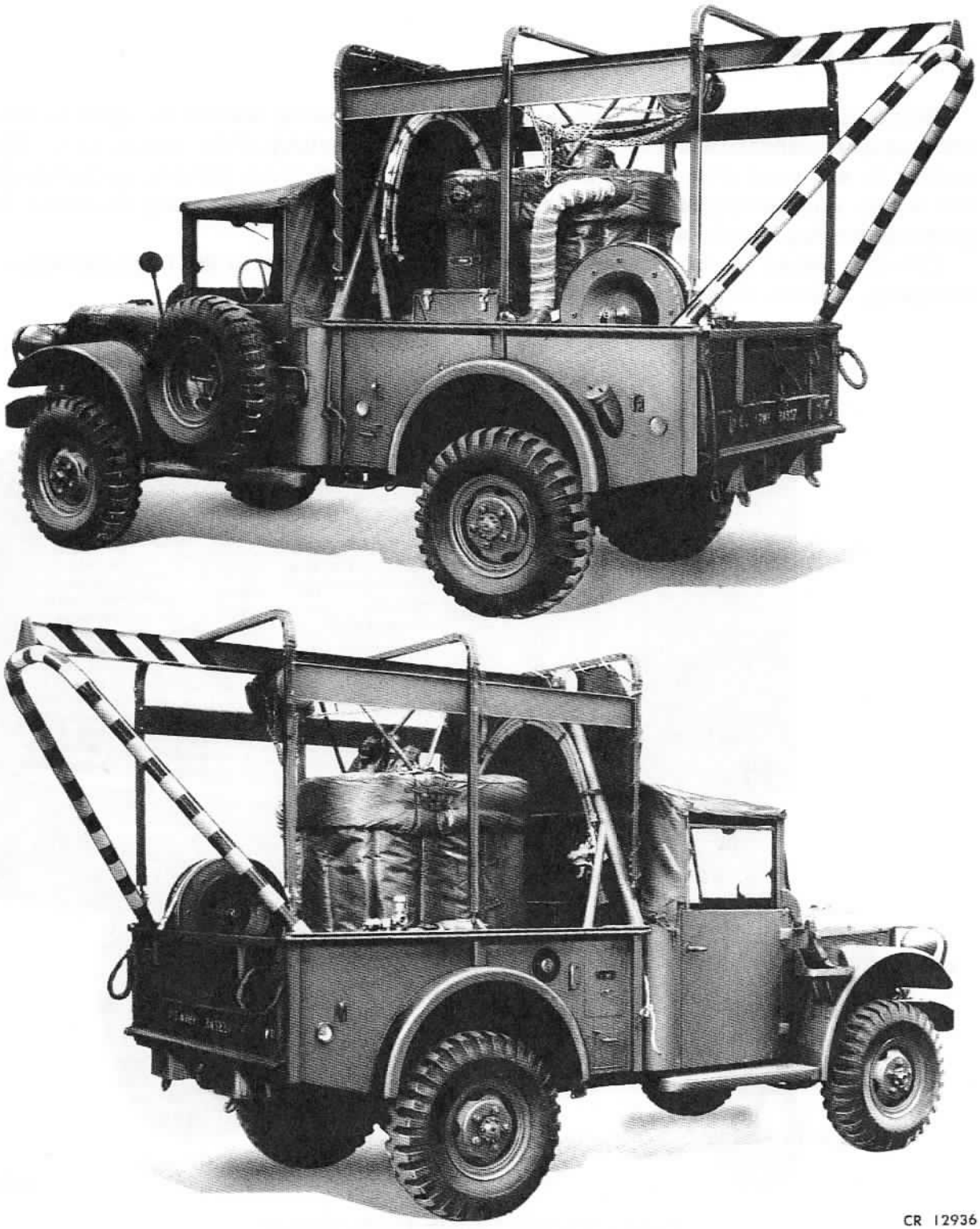

Figure III-29 – Hydrogen Peroxide Servicer

REPAIR PARTS TRAILER (XM487)

The repair parts trailer is a modified 1 1/2-ton, two-wheel trailer designed to store and transport standard and tray-size repair parts to the vicinity of the launch site. This trailer is equipped with a detachable, corrugated, sheet-metal housing assembly and two 6-bay rack assemblies. The trailer also contains the necessary facilities for properly storing repair parts carried in bin stock.

Two are issued to the Ordnance Support Company, three to the Engineer Support Company, and one to each Artillery Firing Battery.

CR 3358

Figure III-30 – Repair Parts Trailer

PRESERVATION AND PACKAGING SHOP (XM485)

The preservation and packaging truck is a modified 2 1/2-ton, 6 by 6 truck designed to store and transport packaging and preservation materials. This truck is equipped with a detachable housing assembly, rack assemblies, a work bench, and storage cabinets. The truck also contains the necessary facilities for properly preserving and storing parts of the REDSTONE Missile.

One truck is issued to the Ordnance Support Company.

CR 7578

Figure III-31 – Basic Truck (Bulk Material Repair Parts, Repair Parts, Preservation Packaging)

PNEUMATIC SHOP (XM477)

The pneumatic shop is a 2 1/2-ton, 6 by 6 truck modified to transport and store the equipment required to test and repair pneumatic systems components. The pneumatic shop contains a checkout bench consisting of an electrical and pneumatic compartment, a control well, a holding-fixture test well, and drawers for storing special test fixtures and fittings. The electrical and pneumatic compartment contains components which provide electrical power and air pressure to the control panel during test operations.

One truck is issued to the Ordnance Support Company.

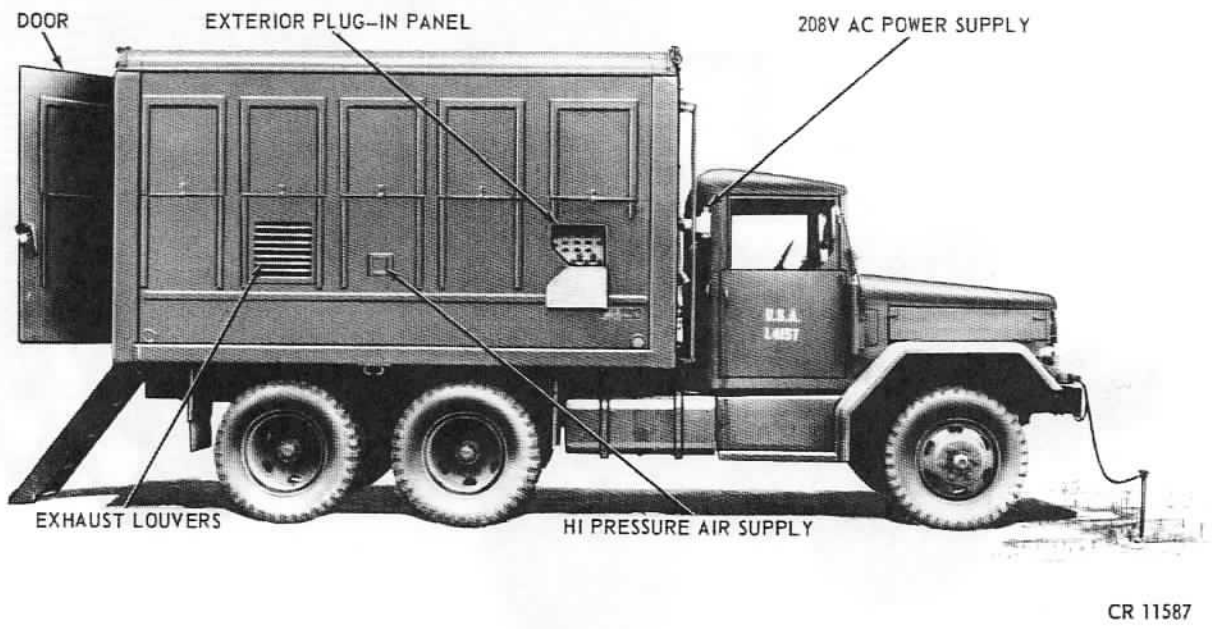

Figure III-32 – Pneumatic Shop Truck

SUPPLY OFFICE (XM484)

The supply office is a 3-ton, two-wheel, semitrailer designed to store and transport the necessary files and clerical equipment used to maintain repair parts records for the REDSTONE Missile. Located along one wall of the supply office is a bookcase, a repair parts record file, a repair basket rack, a graph-o-type embossing machine, and a heater compartment. Along the opposite wall are four Kardex file cabinets, a bookcase, an Addressograph plate storage cabinet, and a classified file.

One supply office is issued to the Ordnance Support Company and to the Engineer Support Company.

Figure III-33 – Supply Office and Prime Mover

STABILIZED PLATFORM TEST STATION (AN/MJM-2)

The stabilized platform test station is a 3-ton, two-wheel van designed to transport and house equipment for accurately testing the ST-80 stabilized platform assembly. The equipment for testing the ST-80 stabilized platform is located in two compartments. The front compartment contains a pedestal test stand, an accuracy test console, the air supply unit, a power panel, and amplifier racks. The rear compartment contains a preset and warmup console, the ST-80 warmup test cart, a power components cabinet, and amplifier racks.

One van is issued to the Ordnance Support Company.

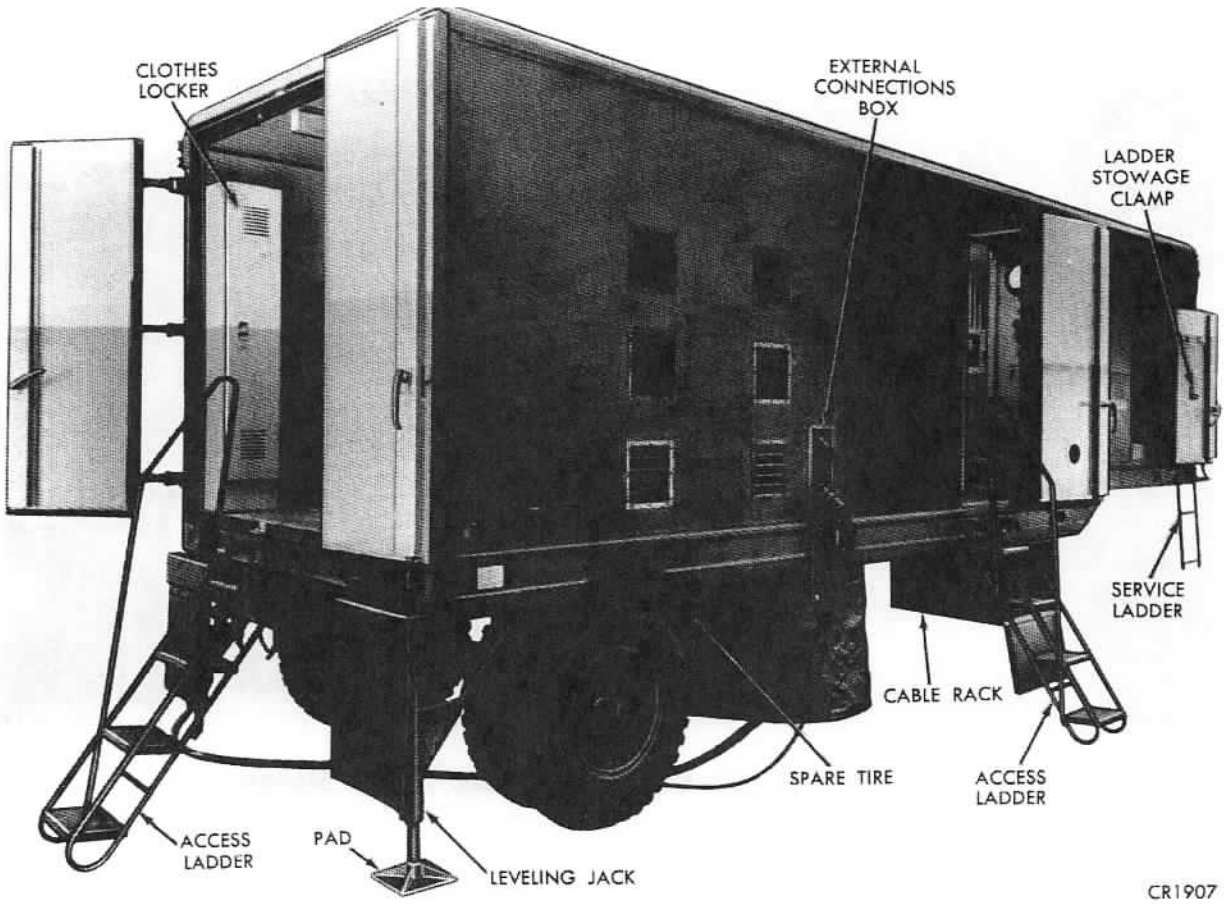

Figure III-34 – Stabilized Platform Test Station (Exterior)

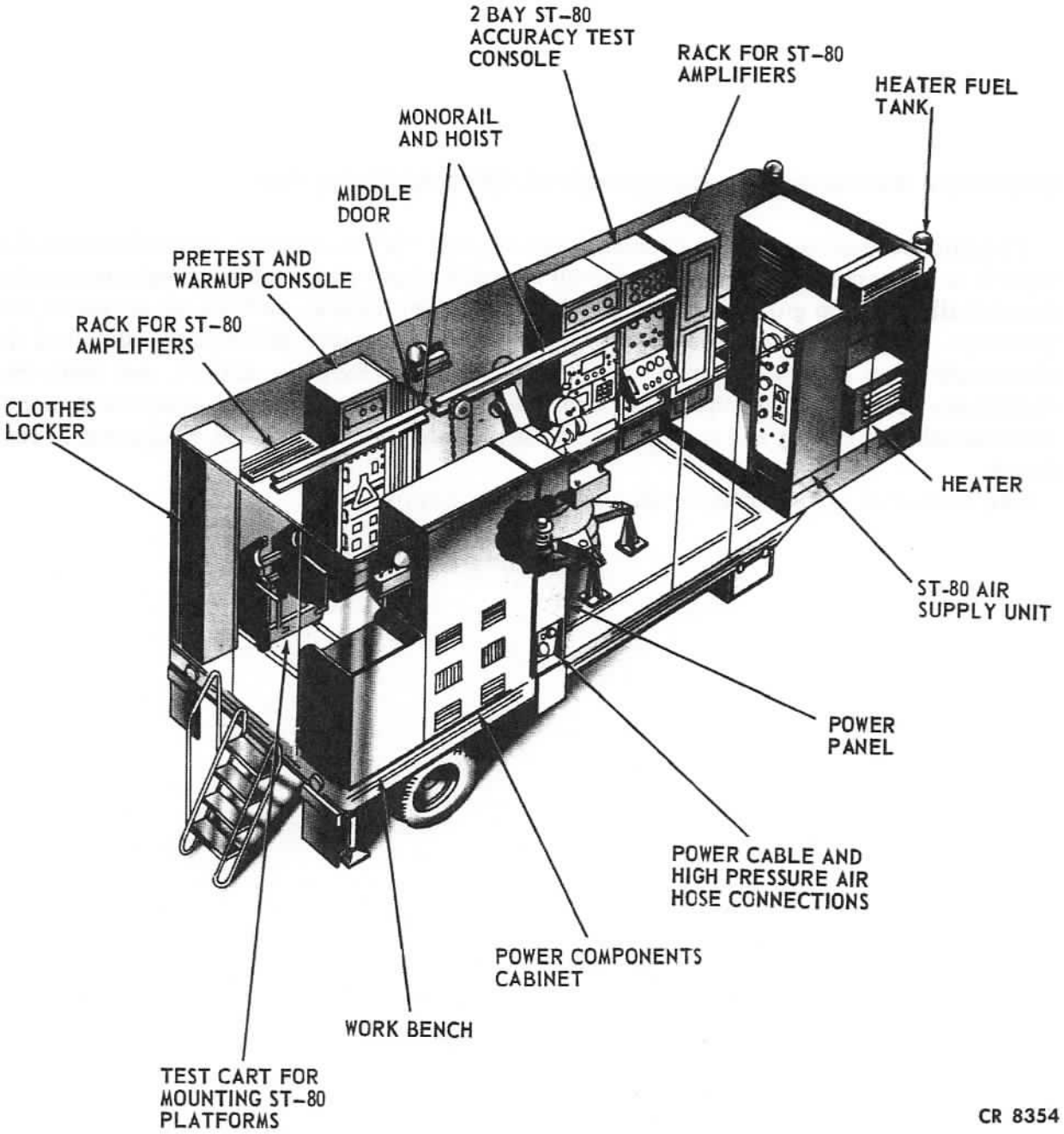

Figure III-35 – Stabilized Platform Test Station (Interior)

GUIDANCE AND CONTROL COMPONENTS TEST TRAILER "A"

The guidance and control components test trailer "A" is a 3-ton, two-wheel van designed to transport and house the ST-80 turn-tilt stand and the equipment required to functionally test the guidance computer, the program device, and the ST-80 stabilized platform. The guidance computer enclosure unit is located at the forward end of the electronic shop and is equipped with a heater and fan, mounts, cables, and cable receptacles. The auxiliary equipment contained in the electronic shop includes a monorail assembly, a trolley and chain hoist, cable reel storage boxes, and equipment access doors.

One trailer is issued to the Ordnance Support Company.

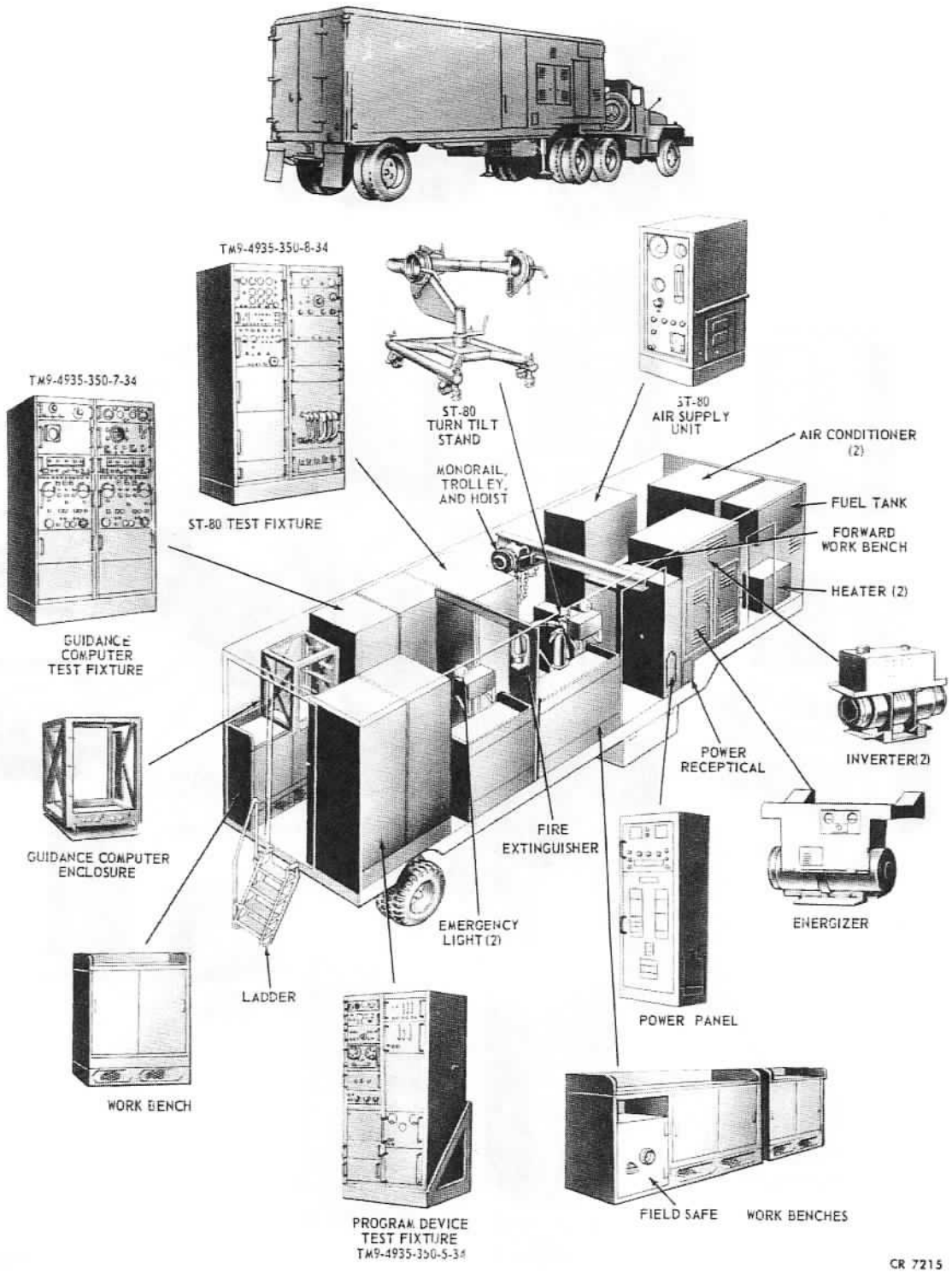

Figure III-36 – Test Trailer A

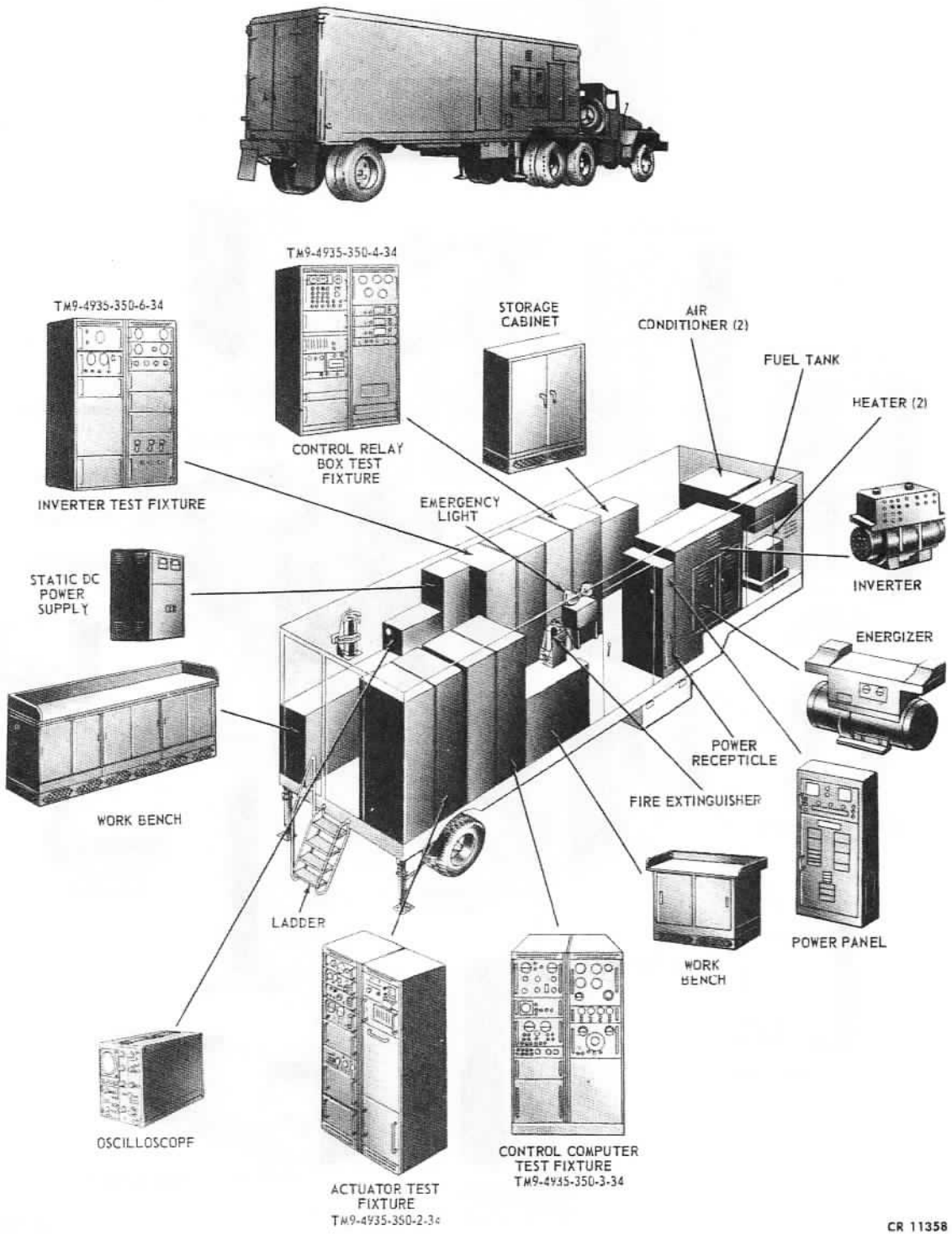

Figure III-37 – Test Trailer B

GUIDANCE AND CONTROL COMPONENTS TEST TRAILER "B"

The guidance and control components test trailer "B" is a 3-ton, two-wheel van designed to transport and store the equipment required to functionally test the control computer, the control relay box, the actuator, and the inverter. A power panel and receptacle, an energizer, an inverter and a static d-c power supply are contained in the trailer to supply power and perform tests on the related components. The auxiliary equipment contained in the trailer includes air conditioning and heating systems, cable reel storage boxes, and equipment access doors.

One trailer is issued to the Ordnance Support Company.

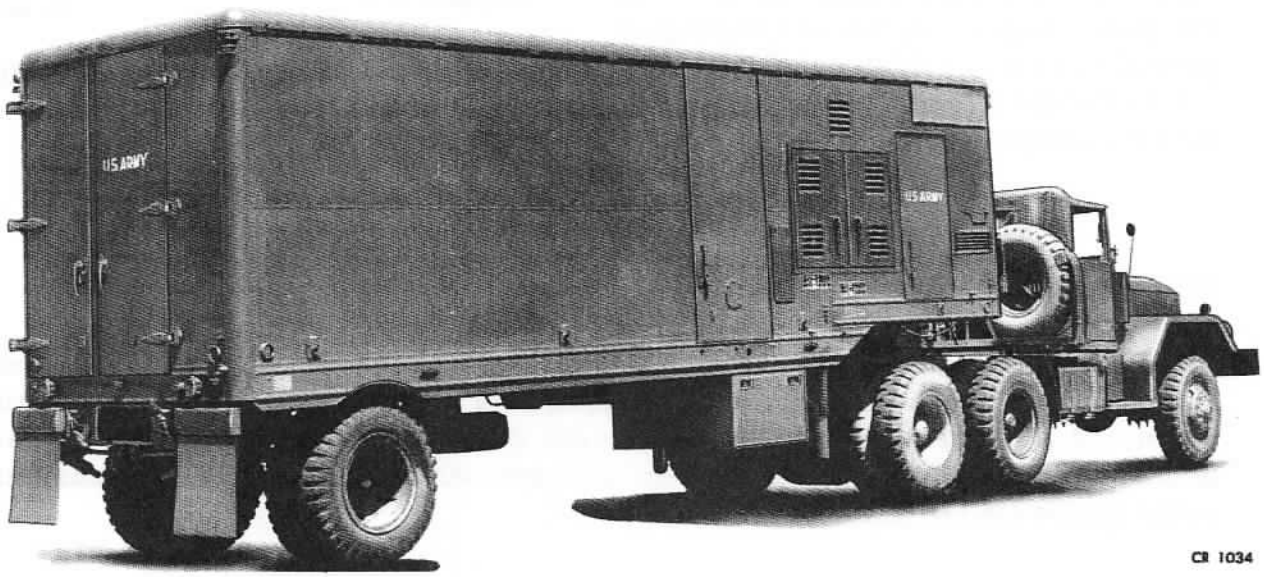

Figure III-38 – Guidance and Control Test Trailer (A or B) and Prime Mover (M52)

CALIBRATION SET – MISSILE SYSTEM TEST EQUIPMENT

The calibration vehicle is a 2 1/2-ton, 6 by 6 shop van modified to accommodate the equipment required to properly calibrate all ground support equipment instrumentation. The cargo area of this vehicle incorporates specially constructed racks and benches to house the calibration equipment and to provide maximum protection during transit. The purpose of the calibration equipment is to assure that every meter, gage, and timer in the ground support equipment will function properly and within tolerance.

One vehicle is issued to the Ordnance Support Company.

CR 10762

Figure III-39 – Calibration Set, Missile System Test Equipment

FIRE-FIGHTING EQUIPMENT SET

The fire truck and the auxiliary water tank trailer are provided to fight operational and brush fires. The fire truck is equipped with a powered pump and fire-fighting turret and also the items necessary to combat fires involving fuel and oxidizers used in the REDSTONE Missile. The 2,000-gallon water tank trailer serves as an auxiliary water source for the fire truck.

GUIDED MISSILE TRAINER, ANALYZER VAN

The analyzer van is a 2 1/2-ton, 6 by 6 vehicle used in the REDSTONE training program. The analyzer van contains simulation equipment which furnishes a complete set of responses normally produced by components in the missile, including traceable malfunction responses. The analyzer van also houses an automatic printer and tape recorder system which records both switch operations and personnel conversations during missile checkout.

One van is issued to the Ordnance Support Company.

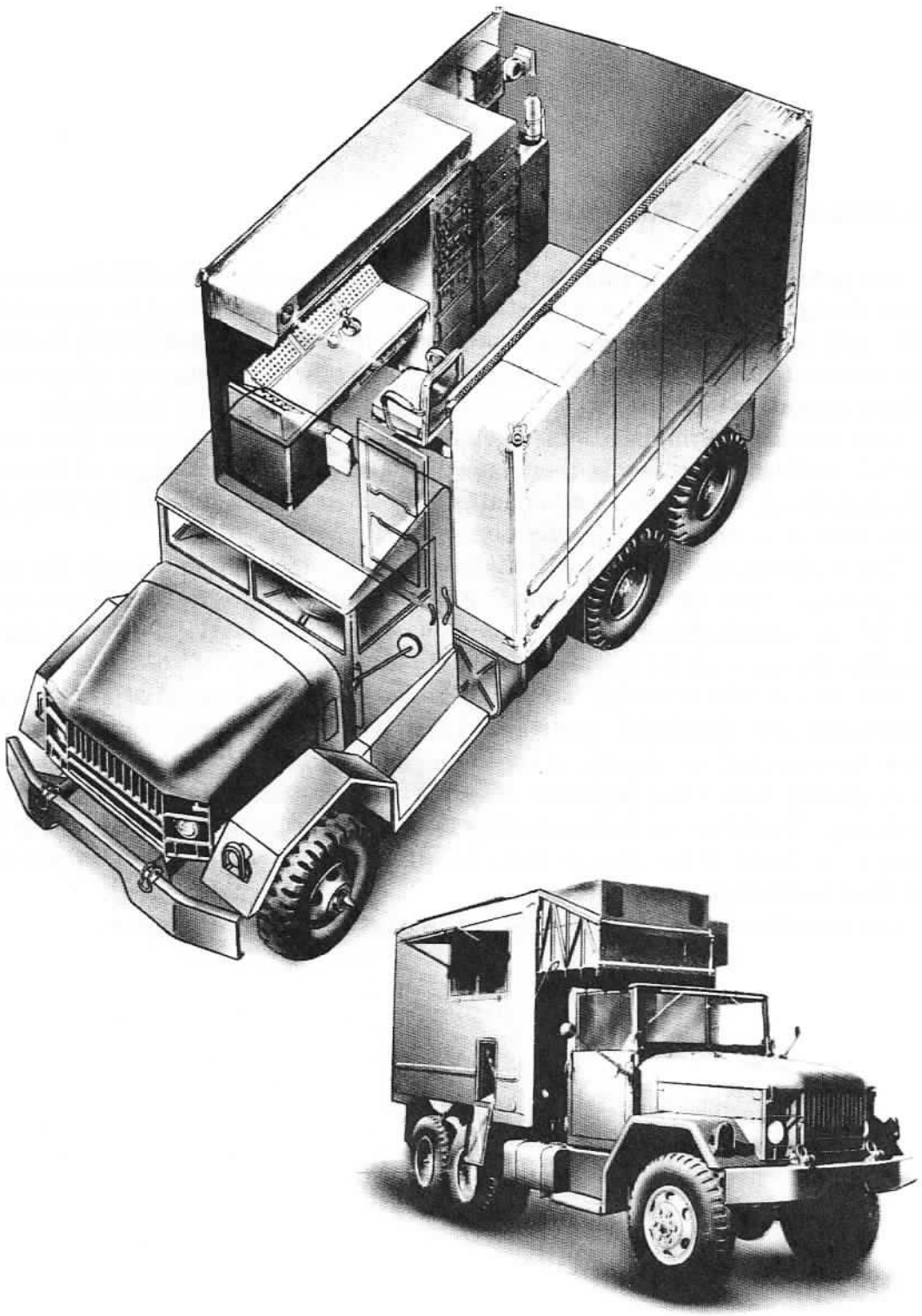

Figure III-40 – Analyzer Van

GUIDED MISSILE TRAINER (AN/MSQ-T2)

The guided missile trainer is a full-scale replica of the REDSTONE Missile. It has been designed to serve as a realistic, long-life trainer which is assembled, checked out, and maintained in the same manner as the tactical REDSTONE Missile. Most of the internal components are duplicated. Inoperative or dummy components are used where operative components are not required for simulation purposes.

Like the tactical missile, the training missile is constructed in four units. All external fueling and pneumatic connections are duplicated. Some of these connections are operative, while others are dummies, but all are capable of receiving the connectors used to service the actual missile.

The warhead unit contains only ballast to give the training missile the proper center of gravity. The aft unit consists of an instrument compartment containing a dummy ST-80 stabilized platform and dummy guidance components. Most of the components contain elements of the traceable-malfunction circuits.

The thrust unit contains a dummy rocket engine, simulated propellant tanks, and pneumatic and electrical systems. LOX is contained in the training missile in a belt tank constructed by placing a second layer of skin 2 1/2 inches inside the outer skin. A 72-gallon tank equipped with overflow lines is utilized for hydrogen peroxide fill training. Training in alcohol fueling is accomplished by using actual fill and vent fittings. In place of an alcohol tank, an external line returns the pumped alcohol to the alcohol semitrailer.

One missile trainer is issued to the Ordnance Support Company.

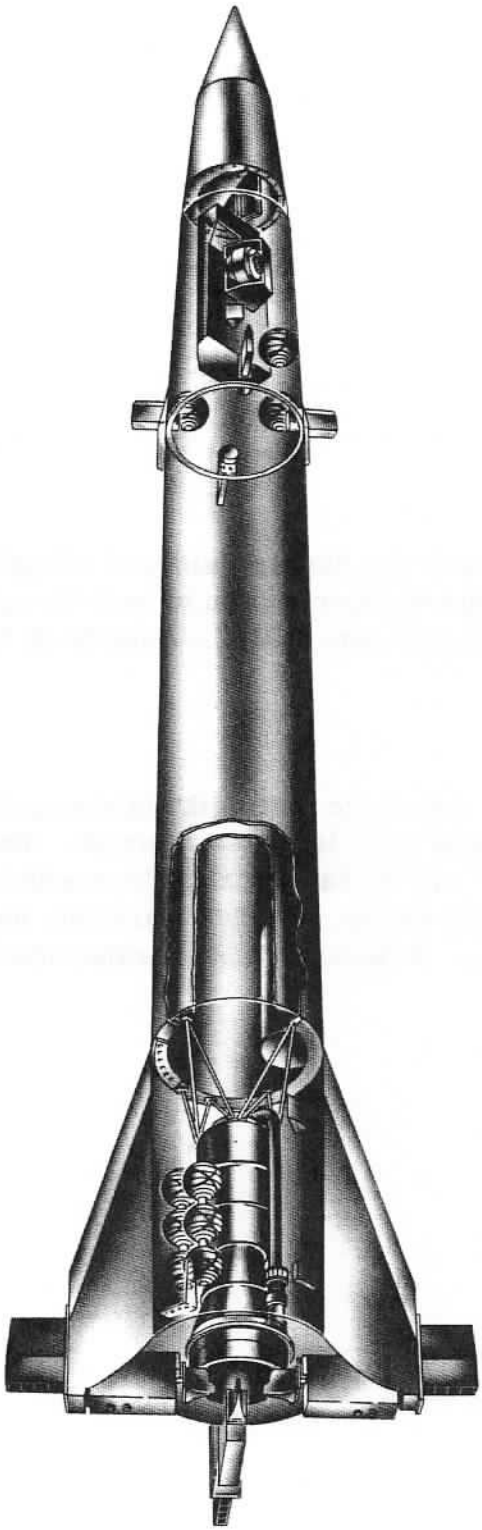

Figure III-41 – Guided Missile Trainer

ST-80 CONTAINER

The ST-80 container is a skid-mounted, drum-shaped container, 49 inches in height and 52 inches in diameter. It is fitted internally with eight coil springs which suspend a handling frame that assures minimum shock and vibration of the ST-80 during shipment. The container has external receptacles to permit pressurization and heating.

The ST-80 is transported to the launch site on an M-105 3/4-ton trailer which is pulled by a prime mover designated by the firing battery commander.

Two containers are issued to the Ordnance Support Company and one to each Artillery Firing Battery.

Figure III-42 – ST-80 Container

LIQUID NITROGEN CONTAINER

The liquid nitrogen container is a cryogenic tank that has a capacity of 150 gallons. Its function is to supply liquid nitrogen to the heater-cooler system to cool the missile instrument compartment. It is transported to the launch site on a 2 1/2-ton M-35 truck.

MISSILE LAYING KIT

The purpose of the laying kit is to orient the missile to permit the lateral guidance system to be keyed to the theoretical ballistic path from launcher to target. The following equipment is required at the launch site: two Wilde T-2 theodolites with tripod and accessories, one Wilde T-2 precise traverse target, one pocket transit, one 30-meter steel tape, and two surveyor's umbrellas. This equipment is transported on a 1/4-ton, 4 by 4, utility truck.

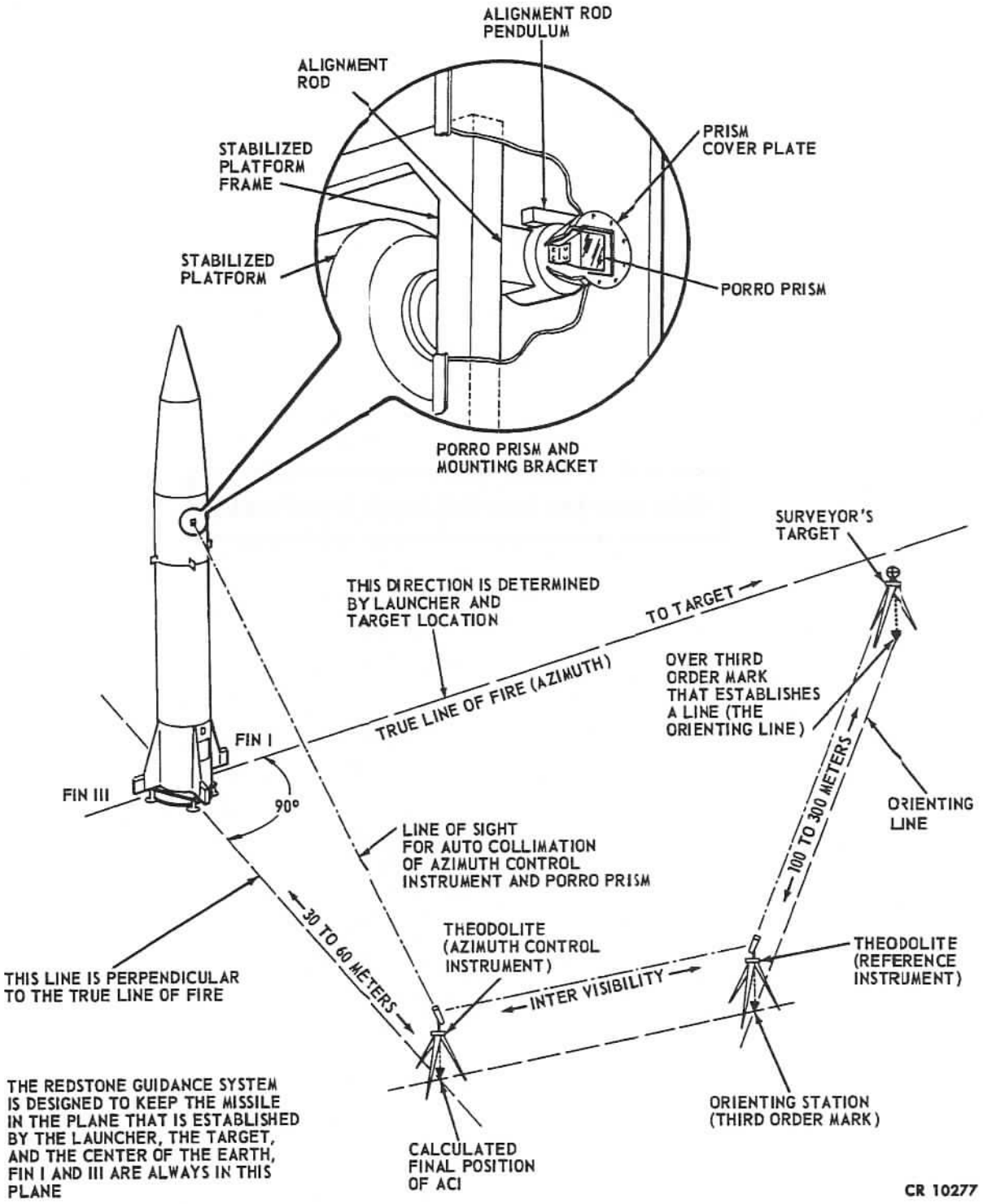

Figure III-43 – Missile Laying

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